ENERGY ENGINEERING ANALYSIS PROGRAM

AT

FORT LEAVENWORTH, KANSAS

FINAL SUBMITTAL

ENERGY SURVEY BUILDING 111 - BELL HALL EXECUTIVE SUMMARY

CONTRACT NUMBER DACA41-86-C-0061

JUNE 4, 1990

KANSAS CITY DISTRICT

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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Introduction:

Bell Hall (Building No. 111) at Ft. Leavenworth, constructed in 1957, has undergone one major addition completed in 1986. Bell Hall is primarily used for officer training, which was its original intent. Over the years, equipment loads within the facility have increased, mainly due to increased computer usage. The original construction of this facility did not anticipate the additional computer load and the present mechanical and electrical systems are undersized. The systems are not capable of providing cooling all year; which is a requirement for the new computers. Since it's implementation, the HVAC systems have had problems maintaining environmental control. Saving energy and improving environmental control at the same time for this facility will be a difficult task. Many of the systems don't maintain the minimum temperature and ventilation levels in the building and are shut down most of the time. Modifying these systems to use less energy will require construction modifications to allow proper operation. This increased the cost of the ECO's and made reasonable paybacks difficult to achieve.

Scope:

Under Base Contract No. DACA41-86-C-0061, an energy audit and engineering study Bell Hall Building No. 111 was performed. The scope included the following:

A. Measure supply, exhaust and return air volumes for each air supply system in the building.
B. Review and observe HVAC system controls.
C. Perform a field audit of facility's lighting levels, miscellaneous equipment loads and occupant quantities.
D. Verify lighting and occupant schedules through field observation and personal interview.
E. Provide adequate documentation of field investigation

notes.

F. Develop a computer simulation of the buildings base energy consumption using daily and hourly simulation procedures.

G. Determine possible methods of energy conservation and simulate energy conservation methods using an hourly computer simulation program, and compare results to the base line model.

H. Determine probable construction costs for each energy conservation method and perform a life cycle cost analysis of the project using the information gathered.

Note: The electrical / lighting portion of this project was performed and the ECO's have already been implemented under another contract.

Work Accomplished:

The field survey on Bell Hall at Ft. Leavenworth was started in September of 1986. It included measuring 29 air supply systems, counting all facility lighting, measuring miscellaneous electrical loads, recording zone temperatures, measuring exhaust volumes, measuring boiler combustion efficiency, measuring chillers operating parameters, counting occupants, observing typical facility operation and interviewing occupants and operating personnel. All data collected through this investigation was then entered into a computer database for manipulation.

From the field data, building plans, and previous energy studies we simulated the facility's energy consumption on the PCDOE computer program. Once the base energy consumption of the facility was developed we made additional computer simulation runs for each Energy Conservation Opportunity (ECO). We then determined energy savings and prepared preliminary probable construction cost estimates for each of the ECO's. The savings investment ratio (SIR) was computed

for each ECO. ECO description data, probable construction cost, energy savings and economic analysis are included in Volume I, Section II of this submittal. All computer simulation results are included in Volume II of this submittal.

Building Data

The facility's HVAC system consists of 5 multizone air supply systems, 24 unit ventilators, 1 built up VAV system, 2 packaged single zone DX systems, 6 packaged thru the wall air conditioners, 13 single zone heating and cooling supply systems, 3 make-up air ventilation systems and 240 two-pipe fan coil units. The unit ventilators, multizone air supply systems, built-up VAV system and 2 of the constant volume air supply systems have economizer capability. The fan coil units are two-pipe with one coil which is used for both heating and cooling The Classrooms, Eisenhower Auditorium and Marshall Auditorium have perimeter radiation systems for perimeter heating. These systems are only active when the boiler is operating.

The central heating/cooling plant consist of 3 boilers, 2 chillers, 1 cooling tower and 14 base mounted pumps. Since piping arrangement is a 2-pipe system, the central plant is either providing heating or cooling but is not capable of providing simultaneous heating and cooling. Reference figures No. 1 and 2 for the flow schematics of the heating and cooling at Bell Hall.

Classrooms (Original Facility):

The unit ventilators serve the classrooms in the original part of the facility. They provide ventilation and economizer air in the winter and provide cooling and ventilation air in the summer. The units are manually switched from summer to winter operations by a summer/winter switch located in the boiler room of Bell Hall. In the winter, the economizers on the unit ventilators are activated to allow for winter cooling. The economizer does not look at the room temperature to see if cooling is

required. Therefore, if no cooling air is required, the air is reheated to room temperature by the unit ventilator coil which wastes energy. This control sequence was analyzed in detail under ECO-M7.

Office Wing:

The office wing in the original facility is served from the two-pipe fan coil system for heating and cooling. Ventilation air is provided by a roof-top air handling unit (RTU-3) and is intended to operate all year. However, RTU-3 is out of service and is not allowed to operate in cold temperature due to coil freeze-up. Inspection so this unit indicates that it is badly damaged and needs to be replaced. In addition, unit's pipe insulation is damaged from previous repairs.

Facility Maintenance:

Presently the facility has one maintenance engineer on temporary assignment from 7:30 a.m. to 4:30 p.m. Prior to the installation of the building automation system Bell Hall had three, full time maintenance engineers. These positions were eliminated. None of the air systems in Bell Hall have clean usable filters. Some of the air systems did not even have filters. Based on the condition of air filters and other items requiring periodic maintenance, we recommend the post consider increasing the maintenance operations staff assigned to the building.

BELL HALL BUILDING 111

EXISTING ANNUAL ENERGY CONSUMPTION

ELECTRICITY		
KWH	DOLLARS	MBTU
8,725,854	$461,611	29,781

NATURAL GAS		
THERMS	DOLLARS	MBTU
2.78E-07	$87,550	27,794

TOTAL	
DOLLARS	MBTU
$549,160	57,575

ENERGY CONSERVATION ANALYSIS

ALL ECOs INVESTIGATED -- BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS ($)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
HEATING VENTILATION AND AIR CONDITIONING							
M1	Convert existing multi-zone air handling units to VAV	6015.0	$34,842	$320,775	$352,853	10.1	1.09
M2	Convert office and classrooms to 4-pipe system with VAV	13983.0	$63,500	$3,495,843	$3,845,427	60.6	0.19
M3	Convert existing 2-pipe system to 4-pipe	7448.0	$30,800	$1,720,729	$1,892,802	61.5	0.19
M4	Modified Class Room ventilators outdoor air control sequence	21405.0	$107,363	$77,873	$85,660	0.8	14.40
M5	Condenser water temperature reset	219.0	$3,395	$14,621	$16,083	4.7	1.93
M6	Provide fan shoutdown during night and off peak hours	6573.0	$42,178	$32,168	$35,385	0.8	12.79
M7	Boiler Oxygen Trim Control						
M8	Provide new heat recovery chiller	3302.0	$9,600	$2,150,586	$2,365,645	246.4	0.05
M9	Convert to primary/secondary pumping system	2274.0	$38,680	$314,356	$345,792	8.9	1.01
M10	Reduce cooling tower fan power	186.0	$2,883	$22,359	$24,595	8.5	1.07
BUILDING ENVELOPE							
A1	Install Double Pane Windows	343.0	$1,600	$51,461	$56,607	35.4	0.47
A2	New roof (existing building)	1399.0	$8,600	$135,508	$149,059	17.3	0.86
A3	Reduce qty of dock doors and provide dock seals	271.0	$1,100	$32,313	$35,545	32.3	0.55
A4	Reduce Solar Load with solar films	1942.0	$16,788	$144,891	$159,380	9.5	1.43
A5	Air Curtains	340.0	$1,330	$18,472	$20,319	15.3	1.21
A6	Wall Insulation w/ reduction in window area (option a)	1541.0	$16,800	$1,517,272	$1,668,999	99.3	0.13
A6	Wall Insulation w/ reduction in window area (option b)	1541.0	$16,800	$552,000	$607,200	36.1	0.35

* TOTAL PROJECT COST IS CONSTRUCTION COST + 10% SIOH.

ENERGY CONSERVATION ANALYSIS

ECOs RECOMMENDED -- BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS ($)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
HEATING VENTILATION AND AIR CONDITIONING							
M1	Convert existing multi-zone air handling units to VAV	6015.0	$34,842	$320,775	$352,853	10.1	1.09
M4	Modified Class Room ventilators outdoor air control sequence	21405.0	$107,363	$77,873	$85,660	0.8	14.40
M5	Condenser water temperature reset	219.0	$3,395	$14,621	$16,083	4.7	1.93
M6	Provide fan shoutdown during night and off peak hours	6573.0	$42,178	$32,168	$35,385	0.8	12.79
M9	Convert to primary/secondary pumping system	2274.0	$38,680	$314,356	$345,792	8.9	1.01
M10	Reduce cooling tower fan power	186.0	$2,883	$22,359	$24,595	8.5	1.07
BUILDING ENVELOPE							
A4	Reduce Solar Load with solar films	1942.0	$16,788	$144,891	$159,380	9.5	1.43
A5	Air Curtains	340.0	$1,330	$18,472	$20,319	15.3	1.21

* TOTAL PROJECT COST IS CONSTRUCTION COST + 10% SIOH

ENERGY CONSERVATION ANALYSIS

ECOs REJECTED -- BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS ($)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
HEATING VENTILATION AND AIR CONDITIONING							
M2	Convert office and classrooms to 4-pipe system with VAV	13983.0	$63,500	$3,495,843	$3,845,427	60.6	0.19
M3	Convert existing 2-pipe system to 4-pipe	7448.0	$30,800	$1,720,729	$1,892,802	61.5	0.19
M7	Boiler Oxygen Trim Control						
M8	Provide new heat recovery chiller	3302.0	$9,600	$2,150,586	$2,365,645	246.4	0.05
BUILDING ENVELOPE							
A1	Install Double Pane Windows	343.0	$1,600	$51,461	$56,607	35.4	0.47
A2	New roof (existing building)	1399.0	$8,600	$135,508	$149,059	17.3	0.86
A3	Reduce qty of dock doors and provide dock seals	271.0	$1,100	$32,313	$35,545	32.3	0.55
A6	Wall Insulation w/ reduction in window area (option a)	1541.0	$16,800	$1,517,272	$1,668,999	99.3	0.13
A6	Wall Insulation w/ reduction in window area (option b)	1541.0	$16,800	$552,000	$607,200	36.1	0.35

TOTAL PROJECT COST IS CONSTRUCTION COST + 10% SIOH

ENERGY CONSERVATION ANALYSIS
Bell Hall

Non-ECIP Projects

PROJECT GROUP BELL HALL BLDG 111	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS $	PROJECT COST $	SIMPLE PAYBACK YRS	SIR
GROUP 1						
Modify O.A. Controls Class Room Ventilators	ECO-M4	21405.0	$107,363	$85,660	0.8	14.56
Condenser Water Temp Rese	ECO-M5	219.0	$3,395	$16,083	4.7	1.93
Modulate Cooling Tower Fans	ECO-M10	186.0	$2,883	$24,595	8.5	1.07
Fan Shutdown - Night	ECO-M6	6573.0	$42,178	$35,385	0.8	12.79
GROUP 1 TOTALS		28383.0	$155,819	$161,723	1.0	10.78
GROUP 2						
Install Solar Film	ECO-A4	1942.0	$16,788	$159,380	9.5	1.43
Air Curtains at Dock Doors	ECO-A5	340.0	$1,330	$20,319	15.3	1.21
GROUP 2 TOTALS		2282.0	$18,118	$179,699	9.9	1.03

ECIP Projects

GROUP 3						
Convert Multi-Zone AHU to Variable Air Volume	ECO-M1	6015.0	$34,842	$352,853	10.1	1.09
Convert to Primary Secondary System	ECO-M9	2274.0	$38,680	$345,792	8.9	1.01
GROUP 3 TOTALS		8289.0	$73,522	$698,645	9.5	1.05

BELL HALL BUILDING 111

ENERGY AND COST SAVINGS

TOTAL POTENTIAL ENERGY AND COST SAVINGS

	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS $/YR
GROUP 1	28,383	$155,819
GROUP 2	2,282	$18,118
GROUP 3	8,289	$72,522
TOTAL	38,954	$246,459

PERCENTAGE OF ENERGY CONSERVED

POTENTIAL ENERGY SAVINGS, MBTU	38,954
EXISTING ENERGY CONSUMPTION, MBTU	57,575
PERCENT ENERGY CONSERVED	67.7%

ENERGY USE AND COST

	ENERGY MBTU/YR	ENERGY $/YR
BEFORE ECO IMPLEMENTATION	57,575	$549,160
AFTER ECO IMPLEMENTATION	18,621	$302,701

ENERGY CONSERVATION ANALYSIS
Bell Hall

Non-ECIP Projects

PROJECT GROUP BELL HALL BLDG 111	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS $	PROJECT COST $	SIMPLE PAYBACK YRS	SIR
GROUP 1						
Modify O.A. Controls Class Room Ventilators	ECO-M4	21405.0	$107,363	$85,660	0.8	14.56
Condenser Water Temp Rese	ECO-M5	219.0	$3,395	$16,083	4.7	1.93
Modulate Cooling Tower Fans	ECO-M10	186.0	$2,883	$24,595	8.5	1.07
Fan Shutdown - Night	ECO-M6	6573.0	$42,178	$35,385	0.8	12.79
GROUP 1 TOTALS		28383.0	$155,819	$161,723	1.0	10.78

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M4

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M4) analyzes the energy savings that may be realized by modifying the ventilation air handling unit controls. The modifications will allow for the proper operation of the existing economizer system.

SCOPE:

This E.C.O. simulation (ECO-M4) will modify the controls to the existing classroom ventilation units to permit an effective economizer control operation. The modifications will include control modifications and a change in the sequence of operation for each unit ventilator. The control modifications will modulate the outside air and return air dampers during the cooler seasons of the year, based on the outside air temperature and the room air temperature conditions. The control valve(s) for the heating coil(s) will remain inoperative or closed unless the outside air conditions are below freezing. The control valve will be cracked open only when the outside air temperature drops below a determined set-point to prevent coil freezing. The room heating requirements will be satisfied by the existing fin tube radiation system.

Reference Figure No. 1. Modifications to the existing unit ventilators will require new temperature sensors, sequencing relays, and controllers to operate the face and bypass dampers and to operate the outside air and return air dampers. The existing dampers, damper motors, and room thermostats will remain as installed except for minor calibrations.

MODELING TECHNIQUES:

The changes made to our base model for this simulation inlude the following:

1. Classroom unit ventilators were changed from the modified VAVS (re: **Modeling Techniques, Section I**) system to single zone heating and cooling system (SZRH).

SUMMARY:

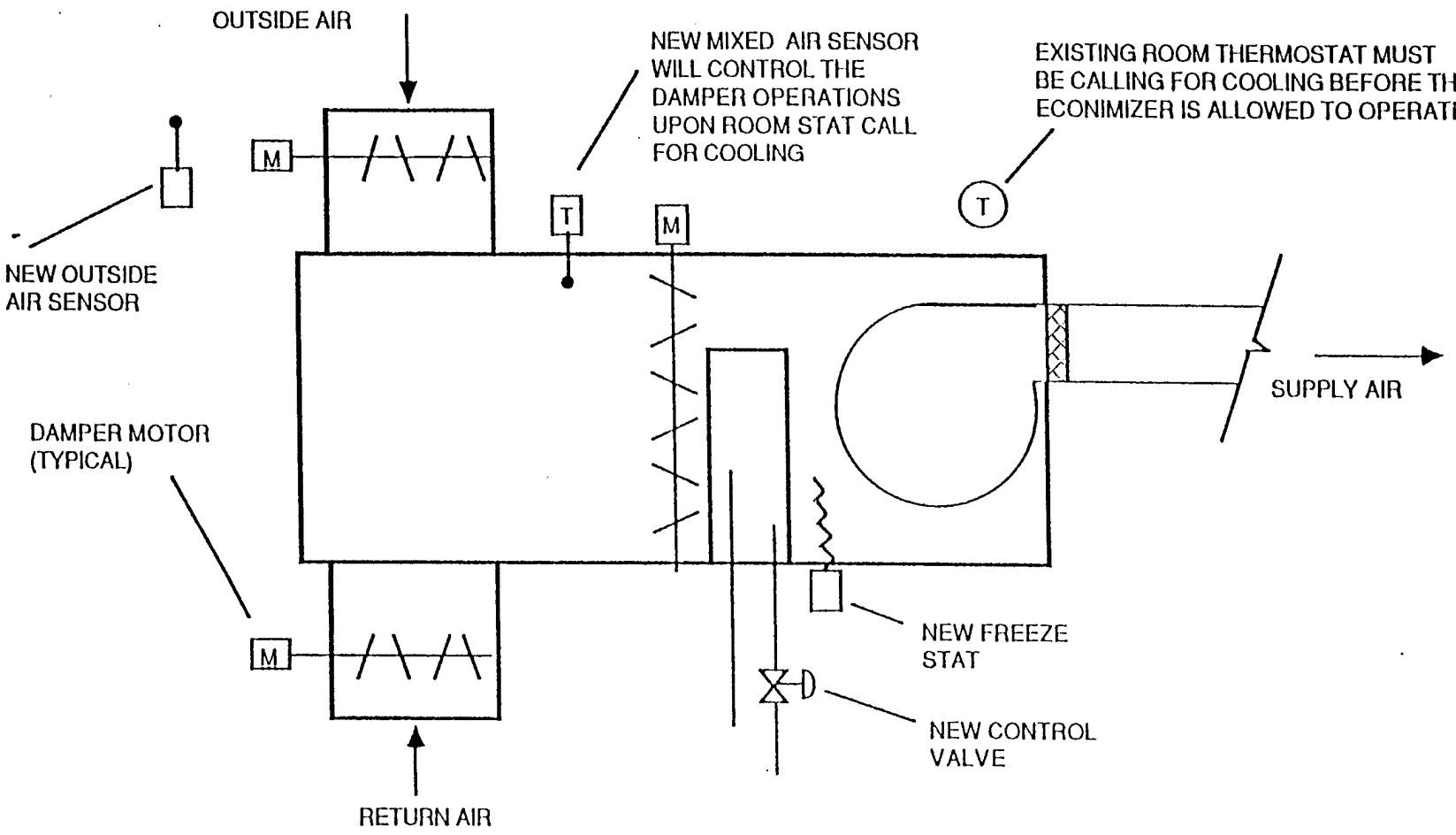
The probable project cost is $85,700. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M4) are approximately 21,400 MBTU per year and $110,400 per year.

The simple payback for this simulation is 0.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 14.56.

DESCRIPTION: MODIFIED AIR HANDLER UNIT



ECO-M4

FIGURE NO. 1

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET OF
	16-Feb-87	1 2

PROJECT: BELL HALL ENERGY STUDY

LOCATION: FORT LEAVENWORTH, KANSAS

ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP

BASIS FOR ESTIMATE

X	CODE A (NO DESIGN COMPLETED)
	CODE B (PRELIMINARY DESIGN)
	CODE C (FINAL DESIGN)
	OTHER (SPECIFY)

DECRIPTION | ESTIMATOR: J.B. | CHECKED BY: G.S.

SUMMARY: ECO-M4	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION WORK TOTAL:				$0		$0	$0
NEW WORK TOTAL:				$38,500		$12,500	$51,000
SUBTOTAL:				$38,500		$12,500	$51,000
CONTINGENCY			10.00%	$3,850	10.00%	$1,250	$5,100
SUBTOTAL				$42,350		$13,750	$56,100
COMP., TAX. SOC. SEC., INS.			13.50%	$5,717	3.50%	$481	$6,199
SUBTOTAL				$48,067		$14,231	$62,299
OVERHEAD AND PROFIT			25.00%	$12,017	25.00%	$3,558	$15,575
CONSTRUCTION COSTS:							$77,873

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 2 OF 2
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X — CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	___ CODE B (PRELIMINARY DESIGN)	
	___ CODE C (FINAL DESIGN)	
	___ OTHER (SPECIFY)	
DECRIPTION: ECO-M4 (CLASS ROOMS)	ESTIMATOR: J.B.	CHECKED BY: G.S.

___ (SUMMARY)	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION:							
NONE				$0		$0	$0
CONSTRUCTION:							
VENTILATION UNIT CONTROL MOD.	24	EA	$1,500.00	$36,000	$500.00	$12,000	$48,000
MOBILIZATION	1	LS	$2,500.00	$2,500	$500.00	$500	$3,000

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: FTLVBDLM
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 — DISCRETE PORTION NAME: ECOM4
ANALYSIS DATE: 05-31-89 — ECONOMIC LIFE 15 YEARS — PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	77873.
B. SIOH	$	7787.
C. DESIGN COST	$	3894.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	80599.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	80599.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	3234.	$ 50127.	8.59	430591.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	18170.	$ 57236.	12.76	730325.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		21404.	$ 107363.		$ 1160916.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 383102.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 107363.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 1160916.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 14.40
(IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M5

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M5) analyzes the energy savings that may be realized by allowing the chiller condenser water temperature to be controlled during low ambient wet bulb conditions.

SCOPE:

This E.C.O. simulation (ECO-M5) modifies the existing boiler room condenser piping loop. The modifications will allow the control of the condenser water temperature for optimum chiller operation. The construction work will include new pipe installation, existing pipe modifications, and control modifications.

Reference Figure No. 1 for the boiler room equipment layout and pipe modifications.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

1. The minimum condenser water temperature shown on line 2,340 (re: **Volume II, Section I**) was changed from 85° F. to 65° F.

2. The tower water temperature control was changed from "FIXED" to "FLOAT" on line 2,344.

SUMMARY:

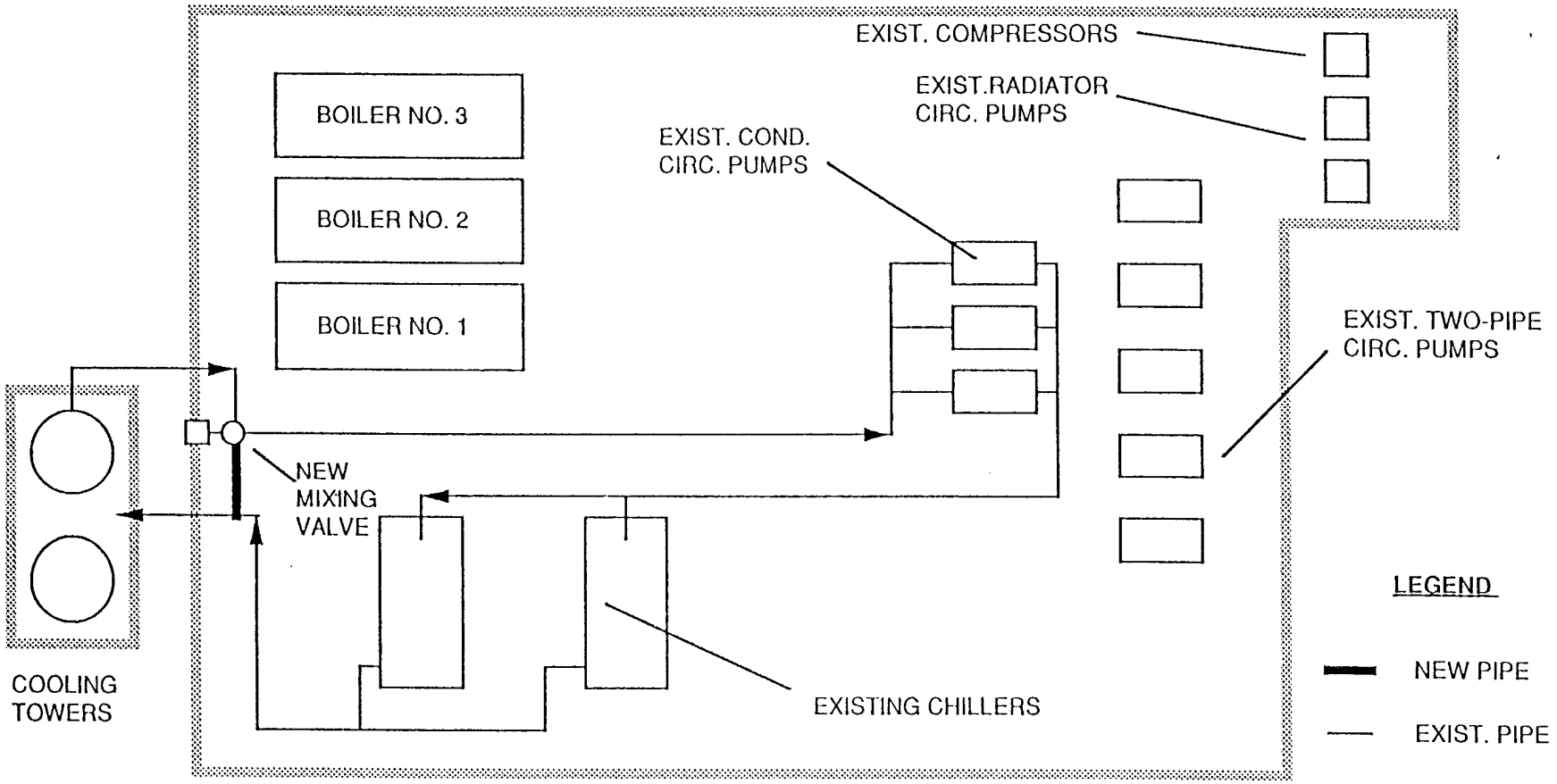
The probable project cost is $14,650. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M5) are approximately 220 MBTU per year and $3,400 per year.

The simple payback for this simulation is 4.3 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.93.

DESCRIPTION: BOILER ROOM WITH MODIFIED CONDENSER PIPING SYSTEM



ECO-M5
FIGURE NO. 1

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 1 OF 2

PROJECT: BELL HALL ENERGY STUDY

LOCATION: FORT LEAVENWORTH, KANSAS

ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP

BASIS FOR ESTIMATE

X — CODE A (NO DESIGN COMPLETED)
___ CODE B (PRELIMINARY DESIGN)
___ CODE C (FINAL DESIGN)
___ OTHER (SPECIFY)

DECRIPTION | ESTIMATOR: J.B. | CHECKED BY: G.S.

SUMMARY: ECO-M5	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION WORK TOTAL:				$0		$0	$0
NEW WORK TOTAL:				$6,004		$3,690	$9,694
SUBTOTAL:				$6,004		$3,690	$9,694
CONTINGENCY			10.00%	$600	10.00%	$369	$969
SUBTOTAL				$6,604		$4,059	$10,663
COMP., TAX. SOC. SEC., INS.			13.50%	$892	3.50%	$142	$1,034
SUBTOTAL				$7,496		$4,201	$11,697
OVERHEAD AND PROFIT			25.00%	$1,874	25.00%	$1,050	$2,924
TOTAL PROJECT COSTS:							$14,621

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CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 2 OF 2

PROJECT: BELL HALL ENERGY STUDY

LOCATION: FORT LEAVENWORTH, KANSAS

ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP

BASIS FOR ESTIMATE:

X — CODE A (NO DESIGN COMPLETED)

____ — CODE B (PRELIMINARY DESIGN)

____ — CODE C (FINAL DESIGN)

____ — OTHER (SPECIFY)

DECRIPTION: ECO-M5 (BOILER ROOM)

ESTIMATOR: J.B.

CHECKED BY: G.S.

_____ (SUMMARY)	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION: NONE	0			$0		$0	$0
CONSTRUCTION: TEMP. GAUGES	4	EA	$7.00	$28	$50.00	$200	$228
PRESS. GAUGES	4	EA	$6.50	$26	$15.00	$60	$86
CONTROL MODIFICATIONS	1	LS	$3,200.00	$3,200	$2,600.00	$2,600	$5,800
MOBILIZATION	1	LS	$2,750.00	$2,750	$830.00	$830	$3,580

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: FTLVBDLM
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM5
ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	14621.
B. SIOH	$	1462.
C. DESIGN COST	$	731.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	15133.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	15133.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	219.	$ 3395.	8.59	29159.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	0.	$ 0.	12.76	0.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		219.	$ 3395.		$ 29159.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 9622.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 3395.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 29159.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.93
(IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M10

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M10) analyzes the energy savings that may be realized by allowing the cooling tower fans to operate with variable speed controllers.

SCOPE:

This E.C.O. simulation (ECO-M10) installs cooling tower fan variable speed controllers. The modification will require installation of the variable speed controller units in the existing boiler room and the electrical modifications to accommodate the controller installation. The construction work will include modifications to the Building Automation System software to monitor and control the variable speed controller unit.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

1. PC-DOE command "TWO-SPEED=TOWER-FAN-CONTROL" was inserted at Line No. 2,346 (re: **Volume II, Section I**)

SUMMARY:

The probable project cost is $24,595. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M10) are approximately 200 MBTU per year and $2,900 per year.

The simple payback for this simulation is 7.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.07.

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET OF
	16-Feb-87	1 2

PROJECT	BASIS FOR ESTIMATE	
BELL HALL ENERGY STUDY		
LOCATION	X	CODE A (NO DESIGN COMPLETED)
FORT LEAVENWORTH, KANSAS		CODE B (PRELIMINARY DESIGN)
ARCHITECT/ENGINEER		CODE C (FINAL DESIGN)
CLARK, RICHARDSON & BISKUP		OTHER (SPECIFY)

DECRIPTION	ESTIMATOR	CHECKED BY
	J.B.	G.S.

SUMMARY: ECO-M10	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
DEMOLITION WORK TOTAL:				$450		$0	$450
NEW WORK TOTAL:				$6,075		$8,556	$14,631
SUBTOTAL				$6,525		$8,556	$15,081
CONTINGENCY			10.00%	$653	10.00%	$856	$1,508
SUBTOTAL				$7,178		$9,411	$16,589
COMP., TAX. SOC. SEC., INS.			13.50%	$969	3.50%	$329	$1,298
SUBTOTAL				$8,146		$9,740	$17,887
OVERHEAD AND PROFIT			25.00%	$2,037	25.00%	$2,435	$4,472
CONSTRUCTION COSTS:							$22,359

ENG. FORM 150
1AVC-59

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 2 OF 2

PROJECT: BELL HALL ENERGY STUDY

LOCATION: FORT LEAVENWORTH, KANSAS

ARCHITECT/ENGINEER: CARK, RICHARDSON & BISKUP

BASIS FOR ESTIMATE:
X CODE A (NO DESIGN COMPLETED)
CODE B (PRELIMINARY DESIGN)
CODE C (FINAL DESIGN)
OTHER (SPECIFY)

DRAWING NO.: ECO-M10 (BOILER)

ESTIMATOR: J.B.

CHECKED BY: G.S.

_____ (SUMMARY)	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION:							
DISCONNECT EXISTING ELEC. SERVICE	1	LS	$450.00	$450		$0	$450
CONSTRUCTION:							
PROVIDE/INSTALL SPEED CONTROLLER	1	LS	$1,750.00	$1,750	$6,225.00	$6,225	$7,975
ELEC. RECONNECT	1	LS	$125.00	$125	$350.00	$350	$475
CONTROLS FOR CONTROLLER	1	LS	$925.00	$925	$1,350.00	$1,350	$2,275
SYSTEM TEST AND BALANCE	1	LS	$1,950.00	$1,950	$280.50	$281	$2,231
MOBILITZATION	1	LS	$1,325.00	$1,325	$350.00	$350	$1,675

ENG. FORM 150
1AVC-59

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVBDLM
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM10
ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	22359.
B. SIOH	$	2236.
C. DESIGN COST	$	1118.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	23142.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	23142.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	186.	$ 2883.	8.59	24765.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	0.	$ 0.	12.76	0.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		186.	$ 2883.		$ 24765.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 8172.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 2883.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 24765.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.07
(IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M6

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M6) analyzes the energy savings that may be realized by turning off air handling units and mechanical equipment during the unoccupied periods of the day.

SCOPE:

This E.C.O. simulation (ECO-M6) will use the existing Building Automation Energy System to turn off existing mechanical equipment and air handling units during the unoccupied periods of the day. The equipment in this simulation includes the following:

1. Ventilation units in the class room areas

2. Ventilation units in the office areas of the general building and Johnson Wing

3. Ventilation units in the library and Marshall areas

4. Mechanical pumps for the chilled water and heating systems

5. Chiller units and associated tower fans and condenser pumps

This work may be accomplished by using the existing building automation system. The existing automation system presently has the capability to monitor and operate the existing mechanical equipment. To accomplish the shut down and start-up characteristics of this simulation, modifications to the building automation system software would be required. The installation of additional control sensors and components to accomplish this simulation will be minimal

compared to the overall project cost of upgrading the existing building automation system.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

1. Schedules named "FAN" and "FAN2" (Re: **Volume I, Section I**) on lines 1,612 and 1,614 were changed from continuous operation to a computer control operation. The fan schedules changed for the fans would de-energize at 10:00 p.m. and restart at 5:00 a.m. on weekdays and de-energize at 6:00 p.m. and restart at 6:00 a.m. on weekends and holidays.

2. Set fan cycling to allow fans to cycle on to maintain a minimum of 55 ° F. (AR -1127) during unoccupied periods.

SUMMARY:

The probable project cost is $35,385. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M6) are approximately 6,600 MBTU per year and $43,000 per year.

The simple payback for this simulation is 0.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 12.79.

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 1 OF 2
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X — CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	CODE B (PRELIMINARY DESIGN)	
	CODE C (FINAL DESIGN)	
	OTHER (SPECIFY)	
DECRIPTION	ESTIMATOR: J.B.	CHECKED BY: G.S.

SUMMARY: ECO-M6	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION WORK TOTAL:				$0		$0	$0
NEW WORK TOTAL:				$8,430		$13,360	$21,790
SUBTOTAL				$8,430		$13,360	$21,790
CONTINGENCY			10.00%	$843	10.00%	$1,336	$2,179
SUBTOTAL				$9,273		$14,695	$23,968
COMP., TAX SOC. SEC., INS.			13.50%	$1,252	3.50%	$514	$1,766
SUBTOTAL				$10,525		$15,210	$25,735
OVERHEAD AND PROFIT			25.00%	$2,631	25.00%	$3,802	$6,434
CONSTRUCTION COSTS:							$32,168

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 2 OF 2

PROJECT: BELL HALL ENERGY STUDY

LOCATION: FORT LEAVENWORTH, KANSAS

ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP

BASIS FOR ESTIMATE:
- X — CODE A (NO DESIGN COMPLETED)
- ___ CODE B (PRELIMINARY DESIGN)
- ___ CODE C (FINAL DESIGN)
- ___ OTHER (SPECIFY)

DECRIPTION: ECO-M6

ESTIMATOR: J.B.

CHECKED BY: G.S.

____ (SUMMARY)	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION:							
NONE				$0		$0	$0
CONSTRUCTION:							
CONTROL MOD. TO AUTOMATION SYSTEM	1	LS	$7,930.00	$7,930	$13,200	$13,200	$21,130
MOBILIZATION	1	LS	$500.00	$500	$160.00	$160	$660

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: FTLVBDLM
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM6
ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	32168.
B. SIOH	$	3217.
C. DESIGN COST	$	1608.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	33294.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	33294.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	1739.	$ 26955.	8.59	231539.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	4833.	$ 15224.	12.76	194258.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		6572.	$ 42178.		$ 425797.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 140513.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 42178.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 425797.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 12.79
(IF < 1 PROJECT DOES NOT QUALIFY)

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BHGROUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 — DISCRETE PORTION NAME: GROUP1
ANALYSIS DATE: 05-31-89 — ECONOMIC LIFE 15 YEARS — PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	147021.
B. SIOH	$	14702.
C. DESIGN COST	$	7351.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	152167.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	152167.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	5378.	$ 83359.	8.59	716054.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	23003.	$ 72459.	12.76	924583.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		28381.	$ 155818.		$ 1640636.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 541410.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 155818.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 1640636.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 10.78
(IF < 1 PROJECT DOES NOT QUALIFY)

FACILITIES ENGINEERING WORK REQUES

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent a

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24	25 26	27 28	29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
XFA						P011		90	06	05	HVAC

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDIN: NUMBE
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24 25 26 27 28	29 30 31	32 33 34 35 36 37	38 39 40	41 42 43 44
XFB	C											

Group 1 AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

ECO M4 - Modify the classroom ventilator controls to allow economizer operation when the outside air is cool enough to provide air conditioning, thus reducing the use of chilled water during moderate outdoor temperatures.
ECO M5 - Modify the condenser water piping and controls to allow operation of the central chillers with a lower condenser water temperature. This will improve the efficiency of the chillers when outdoor conditions are lower than the design temperatures, thus saving electrical energy during a large portion of the operating hours.
ECO M10 - Modify the cooling tower fans and controls to allow the fans to modulate according to the load with variable speed controllers. This will allow more precise control of the condenser water temperature helping to improve chiller efficiency and will also save fan horsepower because of the modulation.
ECO M6 - Reprogram the building automation system and install additional sensors and components to allow the air system fans to be shut off during unoccupied periods. This will save fan horsepower when no ventilation is required.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE

FORWARD FOR APPROVAL

TO	RECOMMENDED ACTION	ENVIRONMENTAL IMPACT (NO / YES)	ESTIMATED COST	WORK TO BE PERFORMED	FROM
APPROVING AUTHORITY	☐ APPROVAL ☐ DISAPPROVAL	☒ ☐ ENVIRONMENTAL CONSIDERATIONS ☒ ☐ EIS/EIA INITIATED ☒ ☐ EIS/EIA COMPLETED	FUNDED $ ____ WC K $ 161,723 WC L $ ____ WC ___ $ ____ UNFUNDED $ 7,351 TOTAL $ 169,074	☐ IN-HOUSE ☐ SELF-HELP ☐ CONTRACT ☐ TROOP	FACILITIES DA

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	FORWA: DESIGN MO	DA
1 2 3	4	5 6	7 8 9 10 11	12	13 14	A – APPROVED D – DISAPPROVED	15 16	17 18	19 20	21
XFC	C									

SIGNATURE OF APPROVAL AUTHORITY

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (C
PINK

ERING WORK REQUEST – XFA, XFB, XFC

am 420–6; the prooonent agency is the Office of the Chief of Engineers.

ON	SHORT JOB DESCRIPTION	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BLANK
	HVAC control modifications			

ACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BLANK

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ventilation is

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

The existing economizer system does not operate efficiently and would therefore continue to waste energy. Chiller will not be at optimum operation which would continue to waste energy. Continued operation of air handling units during "off" hours would waste energy. Inadequate control of cooling tower fans wastes energy.

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.

TO BE
RMED

HOUSE
E–HELP
TRACT
OP

FROM

FACILITIES ENGINEER

DATE

APPROVED FOR DESIGN

SIGNATURE

DATE

SOURCE OF FUNDS

☐ DIRECT
☐ AUTOMATIC REIMB.
☐ FUNDED REIMB.

REMARKS

FORWARDED TO

DESIGN		ESTIMATOR	
MO	DA	MO	DA
19 20	21 22	23 24	25 26

UTHORITY

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK

(2)

ENERGY CONSERVATION ANALYSIS
Bell Hall

Non-ECIP Projects

PROJECT GROUP BELL HALL BLDG 111	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS $	PROJECT COST $	SIMPLE PAYBACK YRS	SIR
GROUP 2						
Install Solar Film	ECO-A4	1942.0	$16,788	$159,380	9.5	1.43
Air Curtains at Dock Doors	ECO-A5	340.0	$1,330	$20,319	15.3	1.21
GROUP 2 TOTALS		2282.0	$18,118	$179,699	9.9	1.03

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-A4

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-A4) analyzes the energy savings of installing solar shading on existing windows.

SCOPE:

The E.C.O. simulation (ECO-A4) installs solar shading on all existing windows.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

1. Comparison of savings for installing solar shading on existing windows which are presently unshaded.

2. The heat transfer characteristics for each window was compared in order to justify the additional cost of the solar shading.

SUMMARY:

The probable project cost is $159,380. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run are approximately 1,942 MBTU per year and $17,000 per year.

The simple payback for this simulation is 9.5 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.43.

CONSTRUCTION COST ESTIMATE	DATE PREPARED 1/20/87	SHEET 1 OF 1

PROJECT: BELL HALL INSTALL SOLAR SHADING

LOCATION: FORT LEAVENWORTH, KS

ARCHITECT/ENGINEER: HOLLIS & MILLER / CRB

BASIS FOR ESTIMATE

____X____ CODE A (NO DESIGN COMPLETED)
_____ CODE B (PRELIMINARY DESIGN)
_____ CODE C (FINAL DESIGN)
_____ OTHER (SPECIFY)

DRAWING NO. | ESTIMATOR | CHECKED BY

SUMMARY: ECO-A4	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SOLAR SHADING ON EXISTING WINDOWS	250	EA	$75.00	$18,750	$325.00	$81,250	$100,000
SUBTOTAL:				$18,750		$81,250	$100,000
CONTINGENCY			10.00%	$1,875	10.00%	$8,125	$10,000
SUBTOTAL				$20,625		$89,375	$110,000
COMP., TAX. SOC. SEC., INS.			13.50%	$2,784	3.50%	$3,128	$5,913
SUBTOTAL				$23,409		$92,503	$115,913
OVERHEAD AND PROFIT			25.00%	$5,852	25.00%	$23,126	$28,978
CONSTRUCTION COSTS:				$29,262		$115,629	$144,891

PREVIOUS EDITION MAY BE USED

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: FTLVEVBDL
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 — DISCRETE PORTION NAME: ECOA4
ANALYSIS DATE: 07-21-87 — ECONOMIC LIFE 25 YEARS — PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	144891.
B. SIOH	$	14489.
C. DESIGN COST	$	7245.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	149962.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	149962.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	864.	$ 13392.	11.05	147982.
B. DIST	$ .00	0.	$ 0.	16.73	0.
C. RESID	$ .00	0.	$ 0.	17.67	0.
D. NAT G	$ 3.15	1078.	$ 3396.	19.36	65741.
E. COAL	$ .00	0.	$ 0.	13.47	0.
F. TOTAL		1942.	$ 16788.		$ 213722.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	11.65	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 70528.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 16788.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 213722.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.43
(IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-A5

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-A5) analyzes the energy savings of installing air curtains on existing dock doors.

SCOPE:

The E.C.O. simulation (ECO-A5) installs air curtains on the existing dock doors.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

1. Comparison of savings for installing air curtains on existing dock doors which presently do not have air curtains.

2. The heat transfer characteristics for each door was compared in order to justify the additional cost of air curtains.

SUMMARY:

The probable project cost is $20,319. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-A1) are approximately 340 MBTU per year and $1,400 per year.

The simple payback for this simulation is 13.2 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.12.

CONSTRUCTION COST ESTIMATE	DATE PREPARED 1/20/87	SHEET 1 OF 1

PROJECT: BELL HALL INSTALL AIR CURTAINS

LOCATION: FORT LEAVENWORTH, KS

ARCHITECT/ENGINEER: HOLLIS & MILLER / CRB

BASIS FOR ESTIMATE:
X — CODE A (NO DESIGN COMPLETED)
___ CODE B (PRELIMINARY DESIGN)
___ CODE C (FINAL DESIGN)
___ OTHER (SPECIFY)

DRAWING NO.

ESTIMATOR: JB

CHECKED BY: GS

SUMMARY: ECO-A5	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
AIR CURTAINS ON EXISTING DOCK DOORS	48	LF	$95.00	$4,560	$155	$7,432	$11,992
MISCELANEOUS ELECTRICAL CONNECTIONS	4	EA	$70.00	$280	$60	$240	$520
SUBTOTAL:				$4,840		$7,672	$12,512
CONTINGENCY			10%	$484	10%	$767	$1,251
SUBTOTAL				$5,324		$8,440	$13,764
COMP., TAX. SOC. SEC., INS.			13.50%	$719	3.50%	$295	$1,014
SUBTOTAL				$6,043		$8,735	$14,778
OVERHEAD AND PROFIT			25.00%	$1,511	25.00%	$2,184	$3,694
CONSTRUCTION COSTS:				$7,553		$10,919	$18,472

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: FTLEVBDL
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS
FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOA5
ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 25 YEARS PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	18472.
B. SIOH	$	1847.
C. DESIGN COST	$	924.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	19119.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	19119.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	21.	$ 326.	11.05	3597.
B. DIST	$ .00	0.	$ 0.	16.73	0.
C. RESID	$ .00	0.	$ 0.	17.67	0.
D. NAT G	$ 3.15	319.	$ 1005.	19.36	19454.
E. COAL	$ .00	0.	$ 0.	13.47	0.
F. TOTAL		340.	$ 1330.		$ 23051.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	11.65	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 7607.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 1330.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 23051.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.21
(IF < 1 PROJECT DOES NOT QUALIFY)

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BHGROUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 — DISCRETE PORTION NAME: GROUP2
ANALYSIS DATE: 05-31-89 — ECONOMIC LIFE 15 YEARS — PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	163363.
B. SIOH	$	16336.
C. DESIGN COST	$	8168.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	169081.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	169081.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	885.	$ 13718.	8.59	117833.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	1397.	$ 4401.	12.76	56151.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		2282.	$ 18118.		$ 173984.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 57415.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 18118.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 173984.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.03
(IF < 1 PROJECT DOES NOT QUALIFY)

FACILITIES ENGINEERING WORK REQUES

For use of this form, see AR 420-17 and DA Pam 420-6; the prooonent a

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24	25 26	27 28	29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
XFA						P0011		90	06	05	HVAC

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDIN: NUMBE
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24 25 26 27 28	29 30 31	32 33 34 35 36 37	38 39 40	41 42 43 44
XFB	C											

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

- call solar film on windows to reduce solar heat gain. Currently this is a major complaint area, because many of the windows are non-operable and on moderate temperature days, (approx. 75°F) the air conditioning is not operating at full capacity and the heat from solar gain causes overheating problems in many offices.
Install air curtains on loading dock to reduce infiltration while trucks are unloading. Air curtains also help keep insects and truck exhaust fumes out of the building while the dock doors are open.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE

FORWARD FOR APPROVAL

TO	RECOMMENDED ACTION	ENVIRONMENTAL IMPACT (NO / YES)	ESTIMATED COST	WORK TO BE PERFORMED	FROM
APPROVING AUTHORITY	☐ APPROVAL ☐ DISAPPROVAL	☒ ☐ ENVIRONMENTAL CONSIDERATIONS ☒ ☐ EIS/EIA INITIATED ☒ ☐ EIS/EIA COMPLETED	FUNDED $ ____ WC K $ 179,699 WC L $ ____ WC ___ $ ____ UNFUNDED $ 8,167 TOTAL $ 187,866	☐ IN-HOUSE ☐ SELF-HELP ☐ CONTRACT ☐ TROOP	FACILITIES DA

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA		FORW: DESIGN MO	D:
1 2 3	4	5 6	7 8 9 10 11	12	13 14	A – APPROVED D – DISAPPROVED	15 16	17 18	SIGNATURE OF APPROVAL AUTHORITY	19 20	21
XFC	C										

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (C
PINK

(1)

RING WORK REQUEST – XFA, XFB, XFC

ım 420–6; the prooonent agency is the Office of the Chief of Engineers.

ON	SHORT JOB DESCRIPTION	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BLANK
37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65	66 67 68 69 70 71	72 73 74	75 76 77 78 79 80	
	HVAC load reduction			

CILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BLANK
37 38 39 40	41 42 43 44 45 46	47 48 49	50 51 52 53 54 55	56 57 58	59 60 61 62 63 64	65 66 67	68 69 70 71 72 73	74 75 76	77 78 79 80

is a major
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capacity and

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DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

Without solar film, office over heating will be a continual source of problems for the office personnel and the maintenance personnel who must respond to complaints. Solar film is a more economical solution than increasing air conditioning capacity.
If air curtains are not installed on the dock doors, infiltration will continue to be a source of wasted energy.
This ECO saves approximately 2282 million BTU's per year.

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.

TO BE
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–HELP
TRACT
OP

FROM

FACILITIES ENGINEER

DATE

APPROVED FOR DESIGN	SOURCE OF FUNDS
SIGNATURE DATE	☐ DIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB.

REMARKS

FORWARDED TO			
DESIGN		ESTIMATOR	
MO	DA	MO	DA
19 20	21 22	23 24	25 26

UTHORITY

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK

(2)

ENERGY CONSERVATION ANALYSIS
Bell Hall

ECIP Projects

PROJECT GROUP BELL HALL BLDG 111	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS $	PROJECT COST $	SIMPLE PAYBACK YRS	SIR
GROUP 3						
Convert Multi-Zone AHU to Variable Air Volume	ECO-M1	6015.0	$34,842	$352,853	10.1	1.09
Convert to Primary Secondary System	ECO-M9	2274.0	$38,680	$345,792	8.9	1.01
GROUP 3 TOTALS		8289.0	$73,522	$698,645	9.5	1.05

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M1

PURPOSE:

The purpose of this Energy Conservation Opportunity run (ECO-M1) is to analyze the energy savings that may be realized by converting the existing multi-zone ventilation units into variable air volume units.

SCOPE:

This E.C.O. simulation (ECO-M1) modifies all of the existing multi-zone ventilation units in the following areas:

1. Basement Office Area
2. Library Area
3. Archive Area
4. Eisenhower Auditorium Area
5. Bookstore and Barber Shop Area

The modifications will convert the existing units from a multi-zone system to a variable air volume system. The conversion includes ductwork modifications, minor piping modifications, control modifications and the installation of a variable speed controller assembly on each air handler unit.

The new ductwork modifications will retain the existing supply and return mains, but new variable air volume control boxes and new supply air diffusers will need to be installed.

The conversion of the ventilation units will include controls for the variable air volume boxes and controls to operate the new variable speed controller unit on each supply air fan. The modifications will require testing and balancing the air systems to assure proper operation.

Reference Figure No. 1 for the floor plan of the multi-zone areas that are being modified into variable air volume systems. Reference Figures No. 2 through 4 for sketches of the ductwork layout in the Archive, Basement and Library Areas.

MODELING TECHNIQUE:

The changes made to our base model for this simulation included the following:

1. The multi-zone system types were changed from MZS to VAVS. This modification was made to all 5 multi-zone systems

2. Speed control option was added under SYSTEM-FANS Keyword Command to simulate the variable frequency drives

SUMMARY:

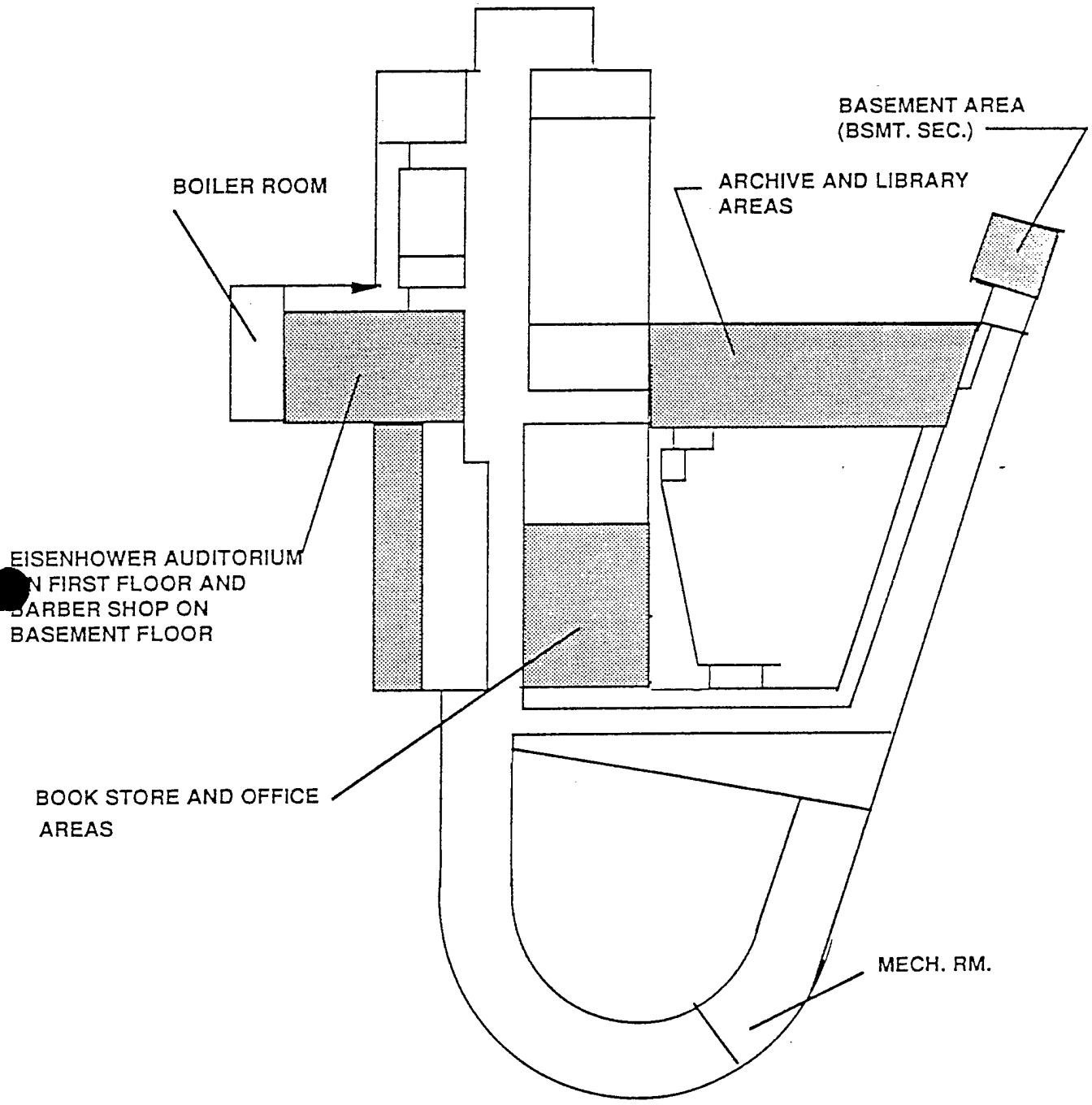
The probable project cost is $352,853. This project cost is the construction cost plus 10% SIOH.

The energy savings realized by this E.C.O. run (ECO-M1) are approximately 6,000 MBTU per year and $35,700 per year.

The simple payback for this simulation is 9.0 years.

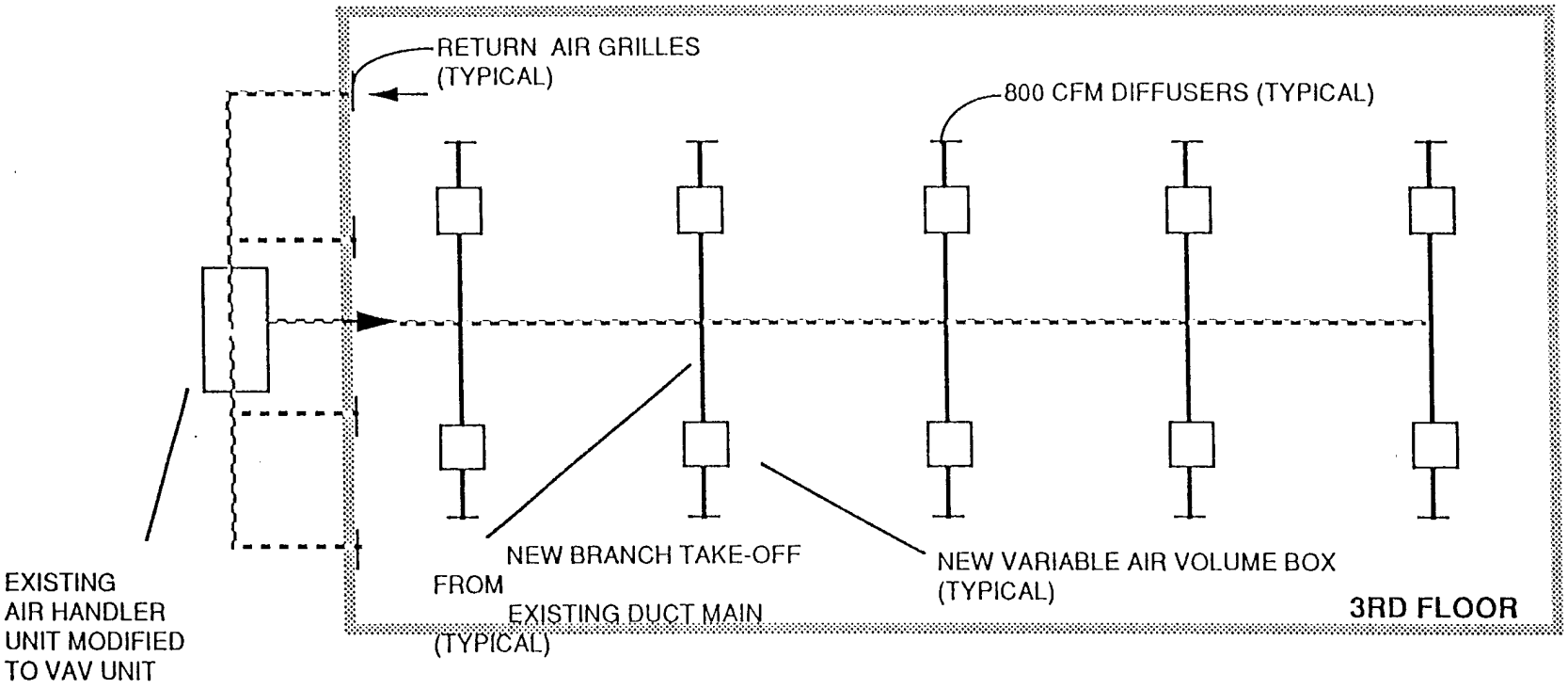
The savings to investment ratio (S.I.R.) for this simulation is 1.09.

DESCRIPTION: FLOOR PLAN OF EXISTING MULTI-ZONE AREAS



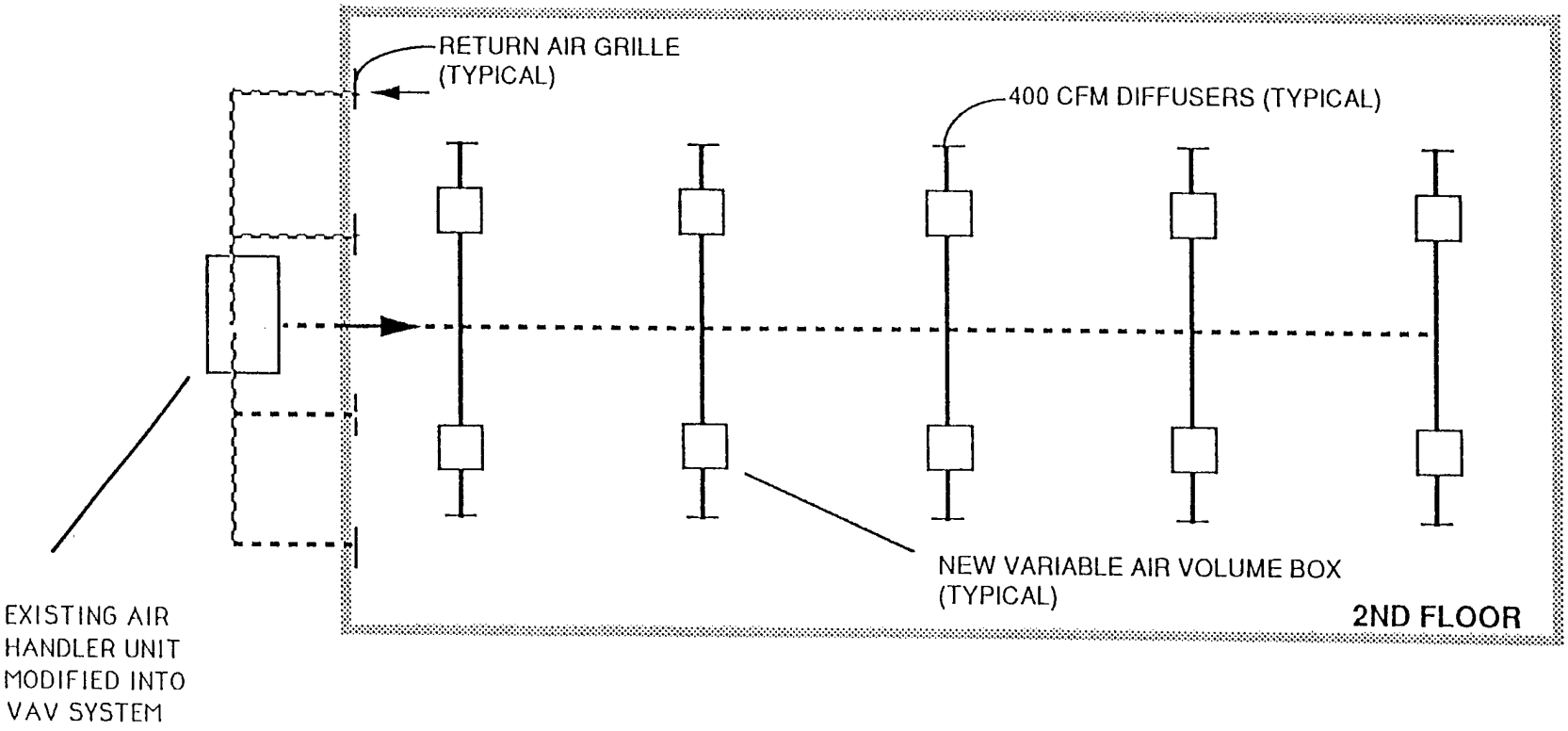
ECO-M1
FIGURE NO.1

DESCRIPTION : ARCHIVE AREA VARIABLE AIR VOLUME SYSTEM



ECO-M1
FIGURE NO. 2

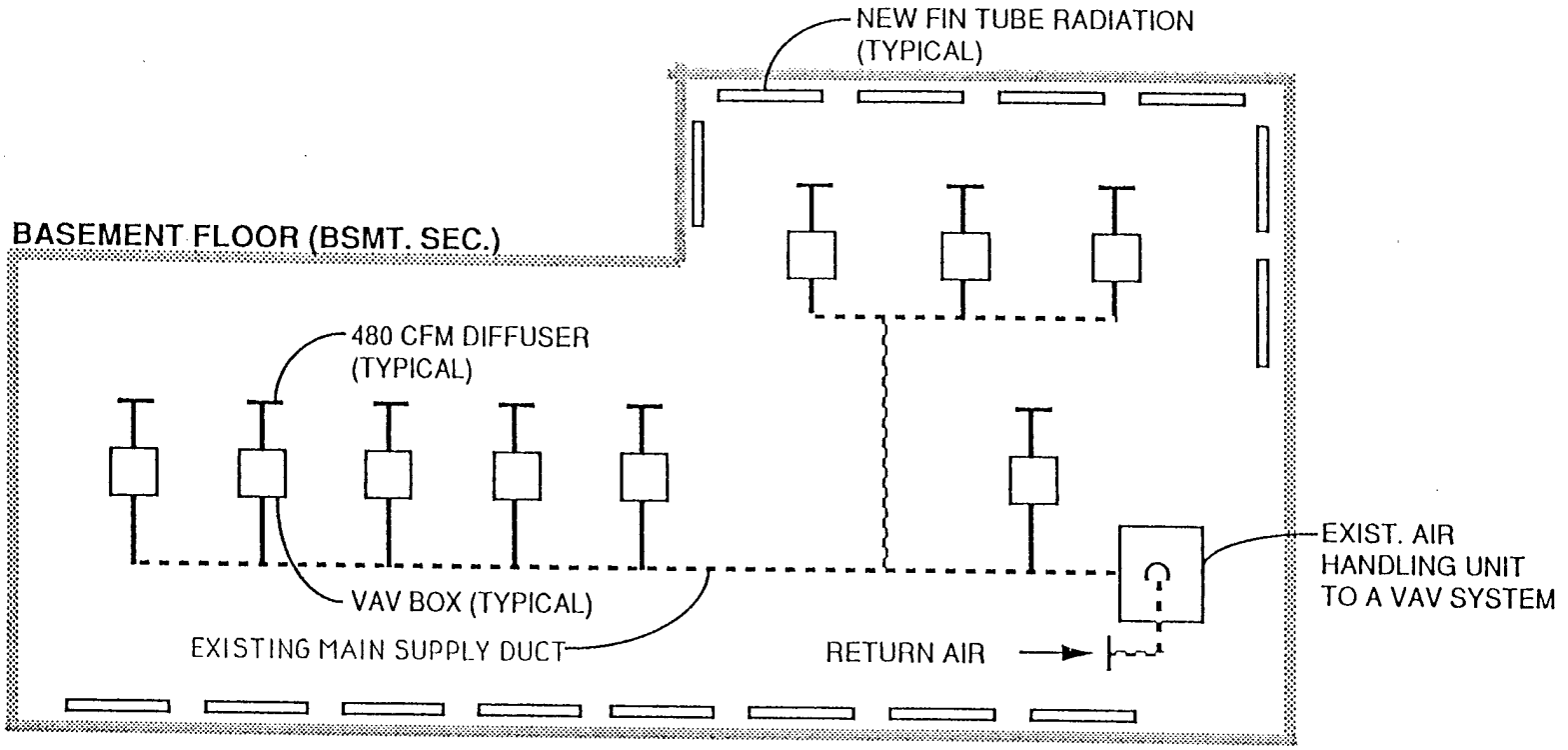
DESCRIPTION : LIBRARY VARIABLE AIR VOLUME SYSTEM



ECO-M1
FIGURE NO. 3

Page 6

DESCRIPTION : MULTIZONE TO VAV MODIFICATION OF BASEMENT AREA



ECO-M1
FIGURE NO. 4

Page 7

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 1 OF 5
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X — CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	___ CODE B (PRELIMINARY DESIGN)	
	___ CODE C (FINAL DESIGN)	
	___ OTHER (SPECIFY)	
DECRIPTION	ESTIMATOR: J.B.	CHECKED BY: G.S.

SUMMARY: ECO-M1	QUANTITY		LABOR		MATERIAL		TOTAL
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
DEMOLITION WORK TOTAL:				$623		$136	$760
NEW WORK TOTAL:				$106,613		$107,668	$214,281
SUBTOTAL:				$107,237		$107,804	$215,041
CONTINGENCY			10%	$10,724	10%	$10,780	$21,504
SUBTOTAL				$117,960		$118,584	$236,545
COMP., TAX. SOC. SEC., INS.			13.50%	$15,925	3.50%	$4,150	$20,075
SUBTOTAL				$133,885		$122,735	$256,620
OVERHEAD AND PROFIT			25.00%	$33,471	25.00%	$30,684	$64,155
CONSTRUCTION COSTS:				$167,356		$153,418	$320,775

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 2 OF 5
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X — CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	CODE B (PRELIMINARY DESIGN)	
	CODE C (FINAL DESIGN)	
	OTHER (SPECIFY)	
DESCRIPTION: ECO-M1(LIBRARY/ARCHIVES)	ESTIMATOR: J.B.	CHECKED BY: G.S.

_____ (SUMMARY)	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
DEMOLITION:							
20" X 6" S.A. GRILLES	24	EA	$0.85	$20	$0.15	$4	$24
CONSTRUCTION:							
20" X 8" S.A. 3RD FLR.	1000	LF	$3.09	$3,090	$15.06	$15,060	$18,150
VAV BOXES 3RD FLR.	18	EA	$380.00	$6,840	$350.00	$6,300	$13,140
14" FLEX CONNECTION	150	LF	$2.08	$312	$0.75	$113	$425
10" X 9" S.A. 2ND FLR.	1000	LF	$2.09	$2,090	$10.22	$10,220	$12,310
10" FLEX CONNECTION	150	LF	$2.09	$314	$0.75	$113	$426
18 VAV BOXES 2ND FLR.	18	EA	$380.00	$6,840	$350.00	$6,300	$13,140
800 CFM DIFFUSERS THIRD FLOOR	18	EA	$20.00	$360	$64.00	$1,152	$1,512
400 CFM DIFFUSERS SECOND FLOOR	18	EA	$20.00	$360	$33.00	$594	$954
VARIABLE SPEED CONTROLLER UNITS	2	EA	$1,500.00	$3,000	$6,000.00	$12,000	$15,000
SYSTEM TEST AND BALANCE	1	LS	$520.00	$520	$100.00	$100	$620
MOBILIZATION	1	LS	$1,030.00	$1,030	$500.00	$500	$1,530
ELEC. CONNECT SERVICE	1	LS	$700.00	$700	$100.00	$100	$800
ELEC. DISCONNECT SERVICE	1	LS	$400.00	$400	$0.00	$0	$400

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 3 OF 5
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	CODE B (PRELIMINARY DESIGN)	
	CODE C (FINAL DESIGN)	
	OTHER (SPECIFY)	
DESCRIPTION: ECO-M1 (BMT OFFICES)	ESTIMATOR: J.B.	CHECKED BY: G.S.

_____ (SUMMARY)	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION:							
480 CFM DIFFUSERS	8	EA	$0.85	$7	$0.15	$1	$8
CONSTRUCTION:							
VAV BOXES	9	EA	$380.00	$3,420	$350.00	$3,150	$6,570
480 CFM DIFFUSERS	9	EA	$25.00	$225	$33.00	$297	$522
14" FLEX CONNECTION	40	LF	$2.08	$83	$0.75	$30	$113
4.0 MBH FIN/TUBE RADIATORS W/COVERS	100	LF	$6.00	$600	$11.75	$1,175	$1,775
VARIABLE SPEED CONTROLLER	1	EA	$1,500.00	$1,500	$6,000.00	$6,000	$7,500
3" HOT WATER PIPE FOR RADIATOR	250	LF	$10.09	$2,523	$8.22	$2,055	$4,578
3/4" PIPE FOR RADIATOR	880	LF	$5.05	$4,444	$3.28	$2,886	$7,330
3/4" ISOLATION VALVES	24	EA	$13.73	$330	$12.33	$296	$625
STATS FOR RADIATORS	12	EA	$35.00	$420	$50.00	$600	$1,020
FIN TUBE HEATER CONTROLS	1	LS	$25.00	$25	$25.00	$25	$50
CEILING REMOVAL/REPLACEMENT	12000	SF	$2.75	$33,000	$0.45	$5,400	$38,400
SYSTEM TEST AND BALANCE	1	LS	$3,500.00	$3,500	$400.00	$400	$3,900
MOBILIZATION	1	LS	$3,500.00	$3,500	$400.00	$400	$3,900

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 4 OF 5
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X — CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	— CODE B (PRELIMINARY DESIGN)	
	— CODE C (FINAL DESIGN)	
	— OTHER (SPECIFY)	
DECRIPTION: ECO-M1 (AUDITORIUM)	ESTIMATOR: J.B.	CHECKED BY: G.S.

_____ (SUMMARY)	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION:							
2000 CFM DIFUSSERS	15	EA	$1.85	$28	$0.25	$4	$32
900 CFM DIFFUSERS	10	EA	$1.85	$19	$0.25	$3	$21
DUCTWORK REPAIR	50	SF	$10.00	$500	$2.00	$100	$600
CONSTRUCTION:							
VAV BOXES ON MAIN LEVEL	9	EA	$380.00	$3,420	$350.00	$3,150	$6,570
VAV BOXES ON LOWER LEVEL	6	EA	$380.00	$2,280	$350.00	$2,100	$4,380
VAV BOXES ON UPPER LEVEL	10	EA	$380.00	$3,800	$350.00	$3,500	$7,300
2000 CFM DIFFUSERS	15	EA	$25.00	$375	$135.00	$2,025	$2,400
1000 CFM DIFFUSERS	10	EA	$25.00	$250	$75.00	$750	$1,000
20" DIA. FLEX DUCT	150	LF	$2.09	$314	$1.50	$225	$539
24" X 17' S.A. DUCTWORK	250	LF	$4.96	$1,240	$24.21	$6,053	$7,293
VARIABLE SPEED CONTROLLER UNIT	1	EA	$1,500.00	$1,500	$6,000.00	$6,000	$7,500
CONTROL MODIFICATIONS	1	LS	$1,000.00	$1,000	$250.00	$250	$1,250
SYSTEM TEST AND BALANCE	1	LS	$2,500.00	$2,500	$300.00	$300	$2,800
MOBILIZATION	1	LS	$2,500.00	$2,500	$500.00	$500	$3,000
ELEC. DISCONNNECT SERVICE	1	LS	$400.00	$400	$0.00	$0	$400
ELEC. CONNECT SERVICE	1	LS	$700.00	$700	$100.00	$100	$800

ENG. FORM 150
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PREVIOUS EDITION MAY BE USED

D-11

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 5 OF 5
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X — CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	CODE B (PRELIMINARY DESIGN)	
	CODE C (FINAL DESIGN)	
	OTHER (SPECIFY)	
DECRIPTION: ECO-M1 (STORE/BARBER)	ESTIMATOR: J.B.	CHECKED BY: G.S.

_____ (SUMMARY)	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION:							
24" X 18" S.A. DUCTWORK	1	LS	$50.00	$50	$25.00	$25	$75
CONSTRUCTION:							
VAV BOX - 2800 CFM	1	EA	$380.00	$380	$350.00	$350	$730
VAV BOX - 400 CFM	1	EA	$380.00	$380	$350.00	$350	$730
DUCTWORK MODIFICATIONS	1	LS	$500.00	$500	$80.00	$80	$580
AHU MODIFICATIONS	1	LS	$250.00	$250	$120.00	$120	$370
VARIABLE SPEED CONTORLLER	1	EA	$1,500.00	$1,500	$6,000.00	$6,000	$7,500
ELEC. DISCONNECT	1	LS	$400.00	$400	$0.00	$0	$400
ELEC. CONNECT	1	LS	$700.00	$700	$100.00	$100	$800
CONTROLS	1	LS	$1,000.00	$1,000	$250.00	$250	$1,250
SYSTEM TEST AND BALANCE	1	LS	$800.00	$800	$100.00	$100	$900
MOBILIZATION	1	LS	$1,000.00	$1,000	$100.00	$100	$1,100

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: FTLVBDLM
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM1
ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$ 320775.
B. SIOH	$ 32078.
C. DESIGN COST	$ 16039.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 332003.
E. SALVAGE VALUE COST	-$ 0.
F. TOTAL INVESTMENT (1D-1E)	$ 332003.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	1287.	$ 19949.	8.59	171358.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	4728.	$ 14893.	12.76	190037.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		6015.	$ 34842.		$ 361395.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.
D. PROJECT NON ENERGY QUALIFICATION TEST		
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	$ 119260.	

A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 34842.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 361395.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.09
(IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M9

PURPOSE:

The purpose of this Energy Conservation Opportunity run (ECO-M9) is to analyze the energy savings that may be realized by converting the existing primary pumping system into a primary-secondary type pumping system. The conversion will retain the existing two- pipe heating and cooling distribution network in the facility.

SCOPE:

This E.C.O. simulation (ECO-M9) converts the existing two-pipe heating and cooling pumping system into a primary-secondary pumping system. The conversion from the existing system to a primary-secondary pumping system will require the following:

1. New primary circulation pumps

2. Modifications to the existing boiler room chilled water piping and boiler piping loops

3. Pipe modifications to connect the existing radiation pumps into the secondary loop

4. New variable speed controller units for each circulation pump

5. New electrical services for the pumps and variable speed controllers

The construction work involved in this simulation may disrupt the heating and cooling capabilities of the boiler room facility during the construction phases.

The installation of the primary and secondary pumping system will require testing and balancing of the hydronic system in the boiler room as well as the distribution network. Reference Figures No. 1 and 2 for the layout of the boiler room equipment and piping.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

1. Since PC-DOE is not capable of calculating pumping energy for primary/secondary pumping (Re: **Section I, Modeling Techniques**), we calculated the average flow required for cooling and heating during one full year. We then calculated what the average head pressure would be for the existing pumps. This information was then used to redefine the pump criteria entered in the input file (Re: **Volume II, Section I**) on line No.'s 2,349 through 2,354. The following pump criteria was changed:

   A. CIRC-DESIGN-T-DROP=9.8
   B. CCIRC-HEAD=29'
   C. HEAT-DESIGN-T-DROP=12.5
   D. HEAT-HEAD=32'

SUMMARY:

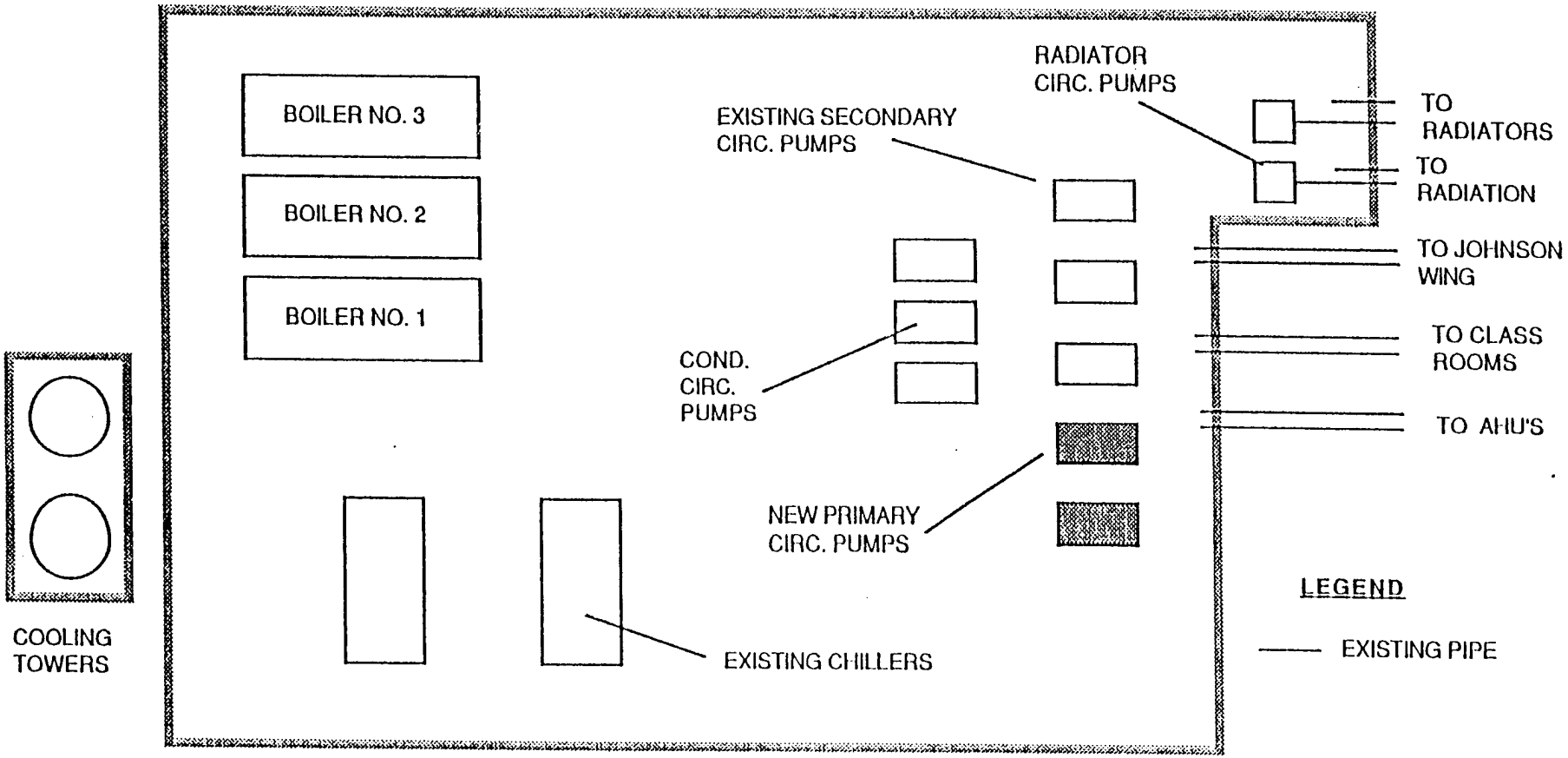
The probable project cost is $345,792. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M9) are approximately 2,280 MBTU per year and $38,700 per year.

The simple payback for this simulation is 8.1 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.01.

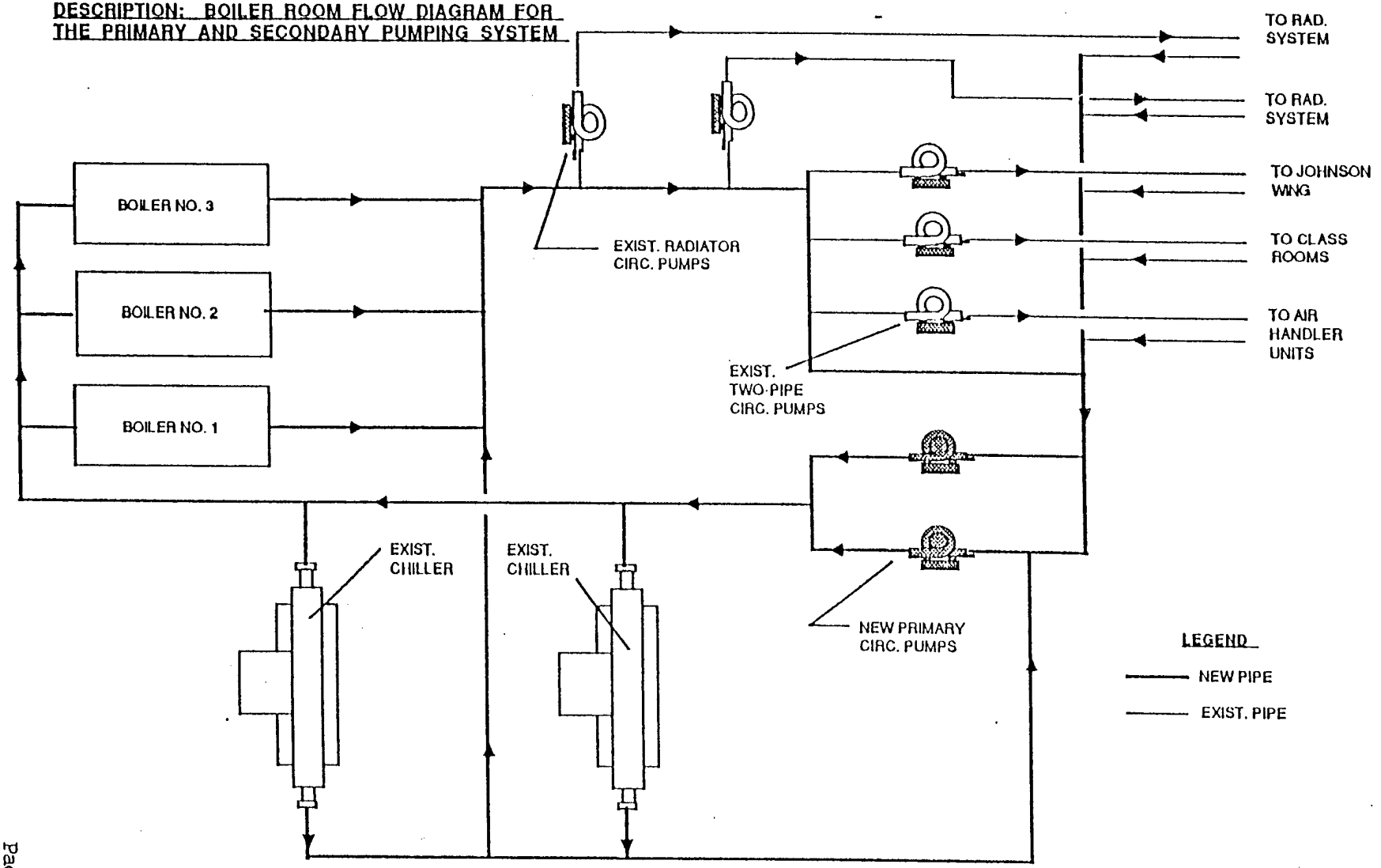
DESCRIPTION: BOILER ROOM EQUIPMENT LAYOUT FOR PRIMARY/SECONDARY PUMPING



ECO-M9

FIGURE NO. 1

DESCRIPTION: BOILER ROOM FLOW DIAGRAM FOR THE PRIMARY AND SECONDARY PUMPING SYSTEM



ECO-M9
FIGURE NO. 2

CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 1 OF 3
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	_____ CODE B (PRELIMINARY DESIGN)	
	_____ CODE C (FINAL DESIGN)	
	_____ OTHER (SPECIFY)	
DECRIPTION	ESTIMATOR J.B.	CHECKED BY G.S.

SUMMARY: ECO-M9	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION WORK TOTAL:				$6,950		$2,276	$9,225
NEW WORK TOTAL:				$87,882		$114,622	$202,504
SUBTOTAL:				$94,832		$116,898	$211,729
CONTINGENCY			10.00%	$9,483	10.00%	$11,690	$21,173
SUBTOTAL				$104,315		$128,587	$232,902
COMP., TAX. SOC. SEC., INS.			13.50%	$14,082	3.50%	$4,501	$18,583
SUBTOTAL				$118,397		$133,088	$251,485
OVERHEAD AND PROFIT			25.00%	$29,599	25.00%	$33,272	$62,871
CONSTRUCTION COSTS:							$314,356

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CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 2 OF 3
PROJECT: BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION: FORT LEAVENWORTH, KANSAS	X CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER: CLARK, RICHARDSON & BISKUP	CODE B (PRELIMINARY DESIGN)	
	CODE C (FINAL DESIGN)	
	OTHER (SPECIFY)	
DESCRIPTION: ECO-M9 (PRIMARY/SECONDARY)	ESTIMATOR: J.B.	CHECKED BY: G.S.

_____ (SUMMARY)	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION:							
REMOVE EXIST. CIRCULATION PUMPS	2	EA	$325.00	$650	$25.00	$50	$700
REMOVE EXIST. ELEC. SERVICE TO PUMPS	2	EA	$140.00	$280	$50.00	$100	$380
REMOVE 12" PIPE	180	LF	$4.65	$837	$1.50	$270	$1,107
REMOVE 8" PIPE	700	LF	$4.65	$3,255	$1.50	$1,050	$4,305
REMOVE 4" PIPE	200	LF	$3.75	$750	$1.15	$230	$980
REMOVE 6" PIPE	250	LF	$3.75	$938	$1.15	$288	$1,225
REMOVE EXIST. CONTROL VALVES	4	EA	$10.00	$40	$12.00	$48	$88
REMOVE EXISTING ISOLATION VALVES	20	EA	$10.00	$200	$12.00	$240	$440
CONSTRUCTION:							
INSTALL 1000 GPM PRIMARY PUMPS	2	EA	$305.00	$610	$2,000.00	$4,000	$4,610
MODIFY EXIST. 350 GPM PUMPS	3	EA	$205.00	$615	$250.00	$750	$1,365
PRIMARY PUMP SPEED CONTROLLER	2	EA	$1,500.00	$3,000	$6,000.00	$12,000	$15,000
SECONDARY PUMP SPEED CONTROLLER	3	EA	$1,500.00	$4,500	$6,000.00	$18,000	$22,500
RADIATOR PUMP SPEED CONTROLLER	2	EA	$1,500.00	$3,000	$6,000.00	$12,000	$15,000
10" CHECK VALVES TO PRIMARY PUMPS	2	EA	$250.00	$500	$3,475.00	$6,950	$7,450
10" PRIMARY ISOLATION VALVES	4	EA	$120.00	$480	$33.00	$132	$612
6" SECONDARY ISOLATION VALVES	6	EA	$90.00	$540	$23.00	$138	$678
8" ISOLATION VALVES-CHILLER/BOILER	8	EA	$110.00	$880	$27.00	$216	$1,096
4" ISOLATION VALVES-CHILLER/BOILER	4	EA	$77.00	$308	$22.00	$88	$396
PRIMARY/SECONDARY PUMP CONTROLS	1	LS	$1,200.00	$1,200	$3,000.00	$3,000	$4,200
12" PIPE	200	LF	$35.00	$7,000	$55.00	$11,000	$18,000
8" PIPE	200	LF	$22.00	$4,400	$32.00	$6,400	$10,800
6" PIPE	150	LF	$8.50	$1,275	$8.00	$1,200	$2,475
4" PIPE	150	LF	$12.00	$1,800	$12.00	$1,800	$3,600
PUMP FLEX. CONNECTION	14	EA	$35.00	$490	$345.00	$4,830	$5,320
NEW TO EXIST. UTILITY CONNECTIONS	10	EA	$223.00	$2,230	$172.00	$1,720	$3,950
8" CONTROL VALVES	4	EA	$800.00	$3,200	$200.00	$800	$4,000

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CONSTRUCTION COST ESTIMATE	DATE PREPARED 16-Feb-87	SHEET 3 OF 3
PROJECT BELL HALL ENERGY STUDY	BASIS FOR ESTIMATE	
LOCATION FORT LEAVENWORTH, KANSAS	X CODE A (NO DESIGN COMPLETED)	
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKUP	CODE B (PRELIMINARY DESIGN)	
	CODE C (FINAL DESIGN)	
	OTHER (SPECIFY)	
DESCRIPTION ECO-M9 (PRIMARY/SECONDARY)	ESTIMATOR J.B.	CHECKED BY F.S.

_____ (SUMMARY)	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
STRAINERS	7	EA	$210.00	$1,470	$500.00	$3,500	$4,970
TEMP. GAUGES	24	EA	$7.00	$168	$50.00	$1,200	$1,368
PRESS. GAUGES	24	EA	$6.00	$144	$20.00	$480	$624
SECONDARY PUMP CHECK VALVES	5	EA	$220.00	$1,100	$2,200.00	$11,000	$12,100
4" TO 6" PIPE FITTINGS	40	EA	$145.00	$5,800	$127.00	$5,080	$10,880
8" TO 12" PIPE FITTINGS	20	EA	$225.00	$4,500	$304.00	$6,080	$10,580
EQUIPMENT MOBILIZATION	1	LS	$1,300.00	$1,300	$430.00	$430	$1,730
PIPING MOBILIZATION	1	LS	$2,500.00	$2,500	$1,000.00	$1,000	$3,500
SYSTEM TEST AND BALANCE	1	LS	$3,000.00	$3,000	$500.00	$500	$3,500
CONNECT PRIMARY PUMP	2	EA	$305.00	$610	$80.00	$160	$770
CONNECT SECONDARY PUMP	3	EA	$300.00	$900	$55.00	$165	$1,065

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LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: FTLVBDLM
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001

INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS · REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS .
FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM9
ANALYSIS DATE: 07-22-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$ 314356.
B. SIOH	$ 31436.
C. DESIGN COST	$ 15718.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 325359.
E. SALVAGE VALUE COST	-$ 0.
F. TOTAL INVESTMENT (1D-1E)	$ 325359.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	2552.	$ 39556.	8.59	339786.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	-278.	$ -876.	12.76	-11174.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		2274.	$ 38680.		$ 328612.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 108442.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 38680.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 328612.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.01
(IF < 1 PROJECT DOES NOT QUALIFY)

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BHGROUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.001
INSTALLATION & LOCATION: FT LEAVENWORTH — REGION NO. 7
PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 — DISCRETE PORTION NAME: GROUP3
ANALYSIS DATE: 05-31-89 — ECONOMIC LIFE 15 YEARS — PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	$	635131.
B. SIOH	$	63513.
C. DESIGN COST	$	31757.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	657361.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	657361.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.50	3840.	$ 59520.	8.59	511277.
B. DIST	$ .00	0.	$ 0.	11.28	0.
C. RESID	$ .00	0.	$ 0.	12.01	0.
D. NAT G	$ 3.15	4450.	$ 14018.	12.76	178863.
E. COAL	$ .00	0.	$ 0.	10.17	0.
F. TOTAL		8290.	$ 73538.		$ 690140.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)		$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 227746.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 73538.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 690140.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.05
(IF < 1 PROJECT DOES NOT QUALIFY)

FACILITIES ENGINEERING WORK REQUES

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent a

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24	25 26	27 28	29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
XFA						P0011		90	06	05	HVAC

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDIN: NUMBE
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24 25 26 27 28	29 30 31	32 33 34 35 36 37	38 39 40	41 42 43 44
XFB	C											

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

Convert existing multi-zone handling units to variable air volume units. Multizone units cool all of the air and then heat part of the air back up to allow mixing of warm and cold air at each room to control space temperature. VAV systems save energy by maintaining a constant cold air temperature and varying the amount of air supplied to a room to control space temperature. Convert the existing chilled water and hot water pumping system to a variable flow primary-secondary system. The existing system is constant flow requiring the same amount of pumping energy regardless of the air conditioning or heating load. A variable flow system can save energy by reducing the flow when it is not required, saving pump horsepower.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE

FORWARD FOR APPROVAL

TO	RECOMMENDED ACTION	ENVIRONMENTAL IMPACT	ESTIMATED COST	WORK TO BE PERFORMED	FROM
APPROVING AUTHORITY	☐ APPROVAL ☐ DISAPPROVAL	NO YES ☒ ☐ ENVIRONMENTAL CONSIDERATIONS ☒ ☐ EIS/EIA INITIATED ☒ ☐ EIS/EIA COMPLETED	FUNDED $ ____ WC K $698,645 WC L $ ____ WC ___ $ ____ UNFUNDED $ 31,756 TOTAL $730,401	☐ IN-HOUSE ☐ SELF-HELP ☐ CONTRACT ☒ TROOP	FACILITIES DA

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	FORW / DESIGN: MO	DESIGN: D
1 2 3	4	5 6	7 8 9 10 11	12	13 14	A – APPROVED D – DISAPPROVED	15 16	17 18	19 20	21
XFC	C									

SIGNATURE OF APPROVAL AUTHORITY

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (
PINK

/ORK REQUEST – XFA, XFB, XFC

5; the prooonent agency is the Office of the Chief of Engineers.

SHORT JOB DESCRIPTION	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BLANK
HVAC modifications			

BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BUILDING/FACILITY NUMBER	BUILDING/FACILITY SUFFIX	BLANK

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DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

If the existing multi-zone units are not converted to VAV, they will continue to waste energy. Additionally money will have to be allocated to correct current control problems. If the existing chilled and hot water pumping system is not converted to variable flow, the system will continue to waste energy and extra capacity may have to be added to allow for future computer loads. A variable flow system can shift water from one zone to another depending on which one needs additional air conditioning.

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.

FROM

FACILITIES ENGINEER

DATE

APPROVED FOR DESIGN	SOURCE OF FUNDS
SIGNATURE _____ DATE _____	☐ DIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB.

REMARKS

FORWARDED TO			
DESIGN		ESTIMATOR	
MO	DA	MO	DA

TY

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK

(2)

PROJECT DEVELOPMENT BROCHURE

facility

BELL HALL
FORT LEAVENWORTH, KANSAS

project coordinator for using service

functional requirements summary, PDB-1

installation: FORT LEAVENWORTH

project: HVAC MODIFICATIONS (BELL HALL)

project number

temporary: _____ program year _____

permanent: _____ category code 80000

point of contact:

user

name _____ date _____

title _____ phone _____

autovon _____

dfae

name _____ date _____

title _____ phone _____

autovon _____

engineer district

name _____ date _____

title _____ phone _____

autovon _____

other (A-E)

name _____ date _____

title _____ phone _____

autovon _____

reviewed by:

installation facility engineer

name _____ date _____

title _____ phone _____

autovon _____

approved by:

macom engineer

name _____ date _____

title _____ phone _____

autovon _____

project development brochure, PDB-1

OBJECTIVE

This project will provide energy savings by increasing the efficiency of the Bell Hall HVAC systems.

CURRENT CONDITIONS

Currently the existing multi-zone air handling units function as constant volume units that supply the same amount of air at varying temperatures. This requires the fans to operate at full capacity all of the time. The existing constant volume chilled water pumping system supplies the same amount of chilled water throughout the building, regardless of the cooling requirement. The temperatures are maintained by mixing return chilled water with the supply chilled water. This requires that the pumps operate at design capacity all of the time.

PROOSED MODIFICATIONS

This project would convert 5 existing multizone air handling units to allow operation as variable air volume units and convert the existing constant volume chilled water pumping system to a variable flow primary/secondary pumping system.

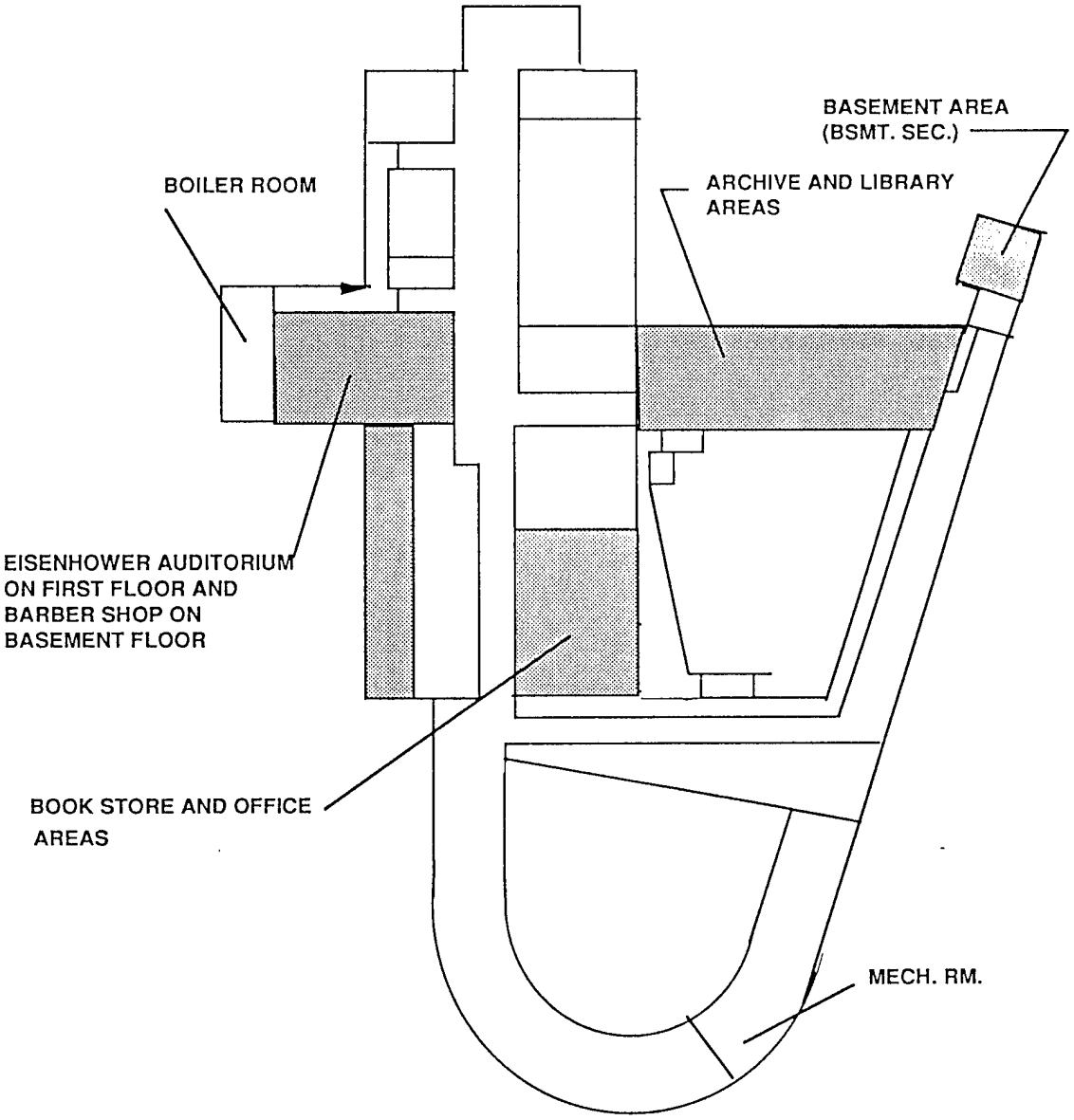
The multizone units converted to VAV would serve the basement office area, library area, archive area, Eisenhower Auditorium area and the bookstore and barbershop area. The conversion would consist of a variable speed controller on the fan motors, control modifications, and installation of variable volume supply boxes in the individual areas.

The conversion of the constant volume pumping system would include, new primary circulation pumps, modifications to the chilled water and heating water piping loops, new variable speed controllers for the secondary circulation pumps and DDC control modifications.

The electrical savings is 8289 MBTU's per year and the the savings to investment ratio is 1.05.

functional requirements summary, PDB-1

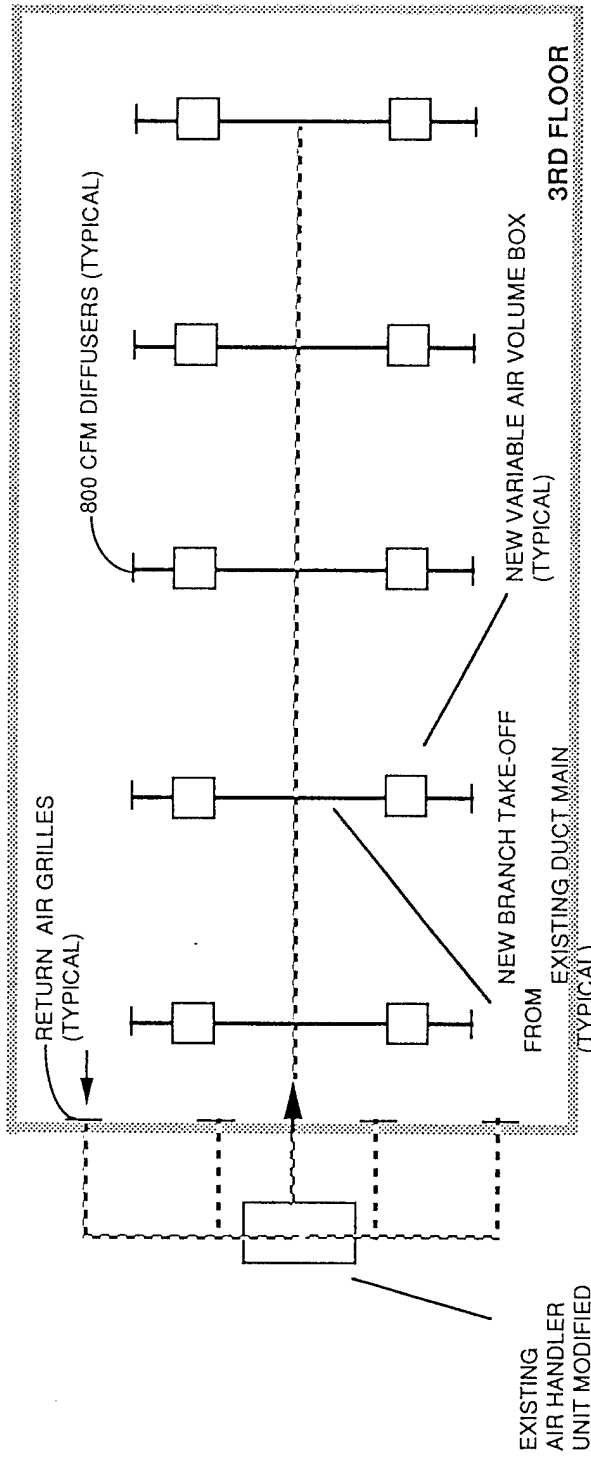
DESCRIPTION: FLOOR PLAN OF EXISTING MULTI-ZONE AREAS



ECO-M1
FIGURE NO.1

facilities requirements sketch, PDB- 1/2

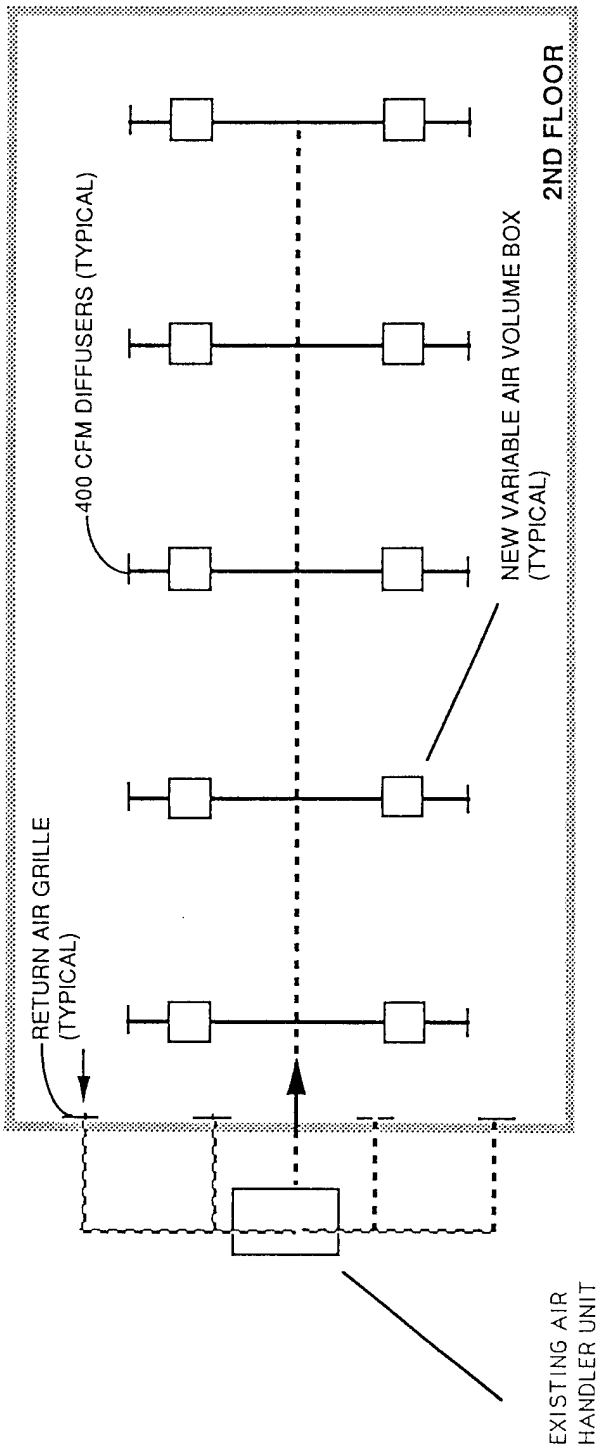
DESCRIPTION : ARCHIVE AREA VARIABLE AIR VOLUME SYSTEM



ECO-M1
FIGURE NO. 2

facilities requirements sketch, PDB- 1/2

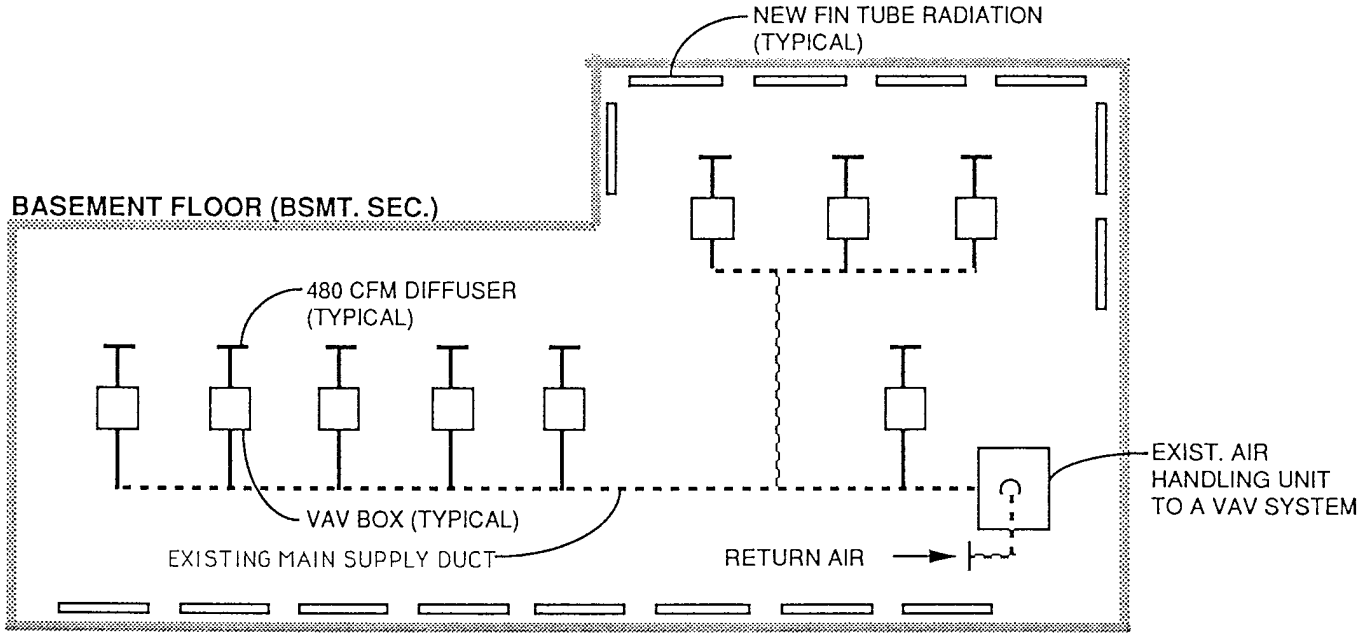
DESCRIPTION : LIBRARY VARIABLE AIR VOLUME SYSTEM



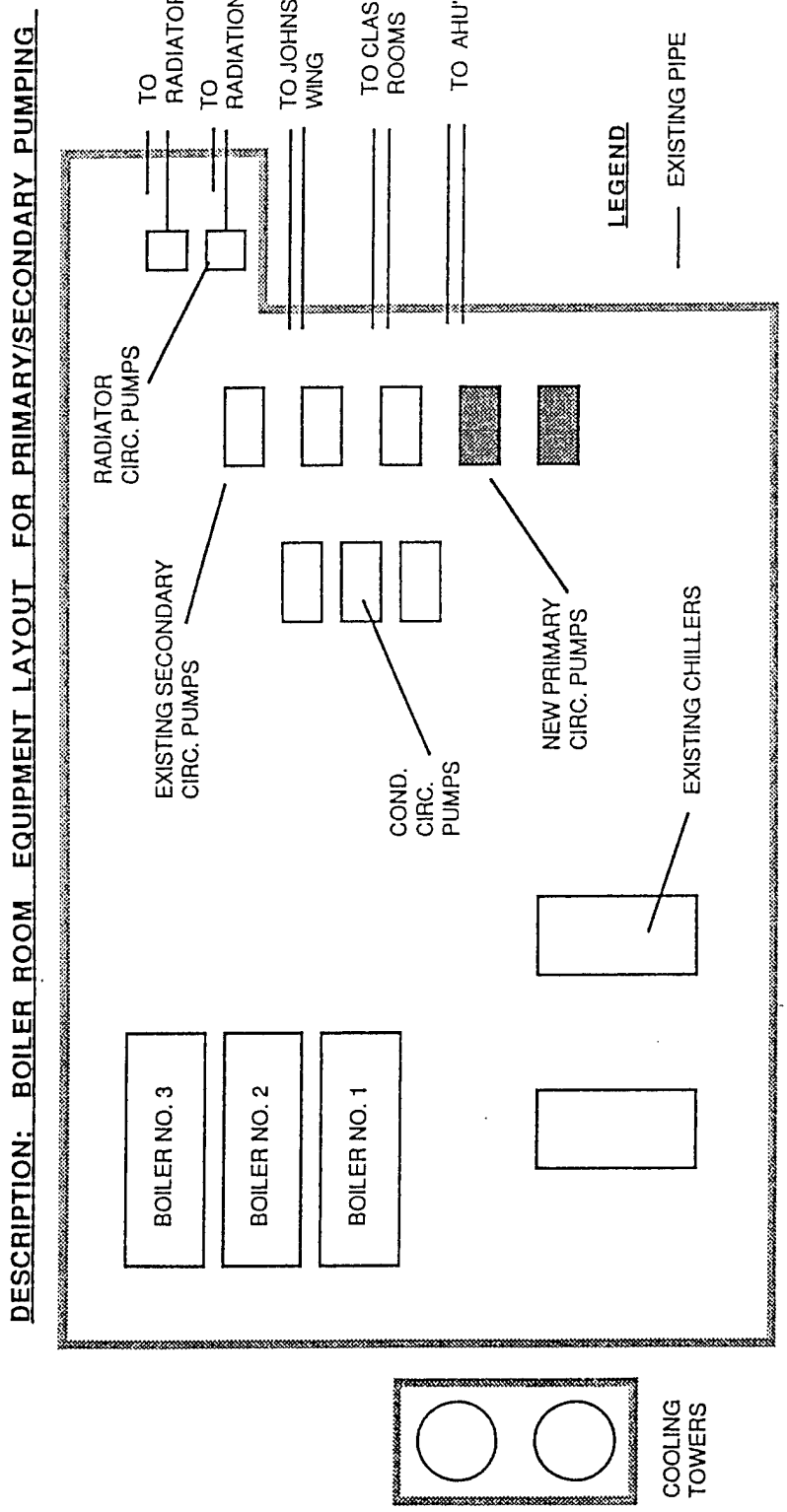
ECO-M1
FIGURE NO. 3

facilities requirements sketch, PDB- 1/2

DESCRIPTION : MULTIZONE TO VAV MODIFICATION OF BASEMENT AREA



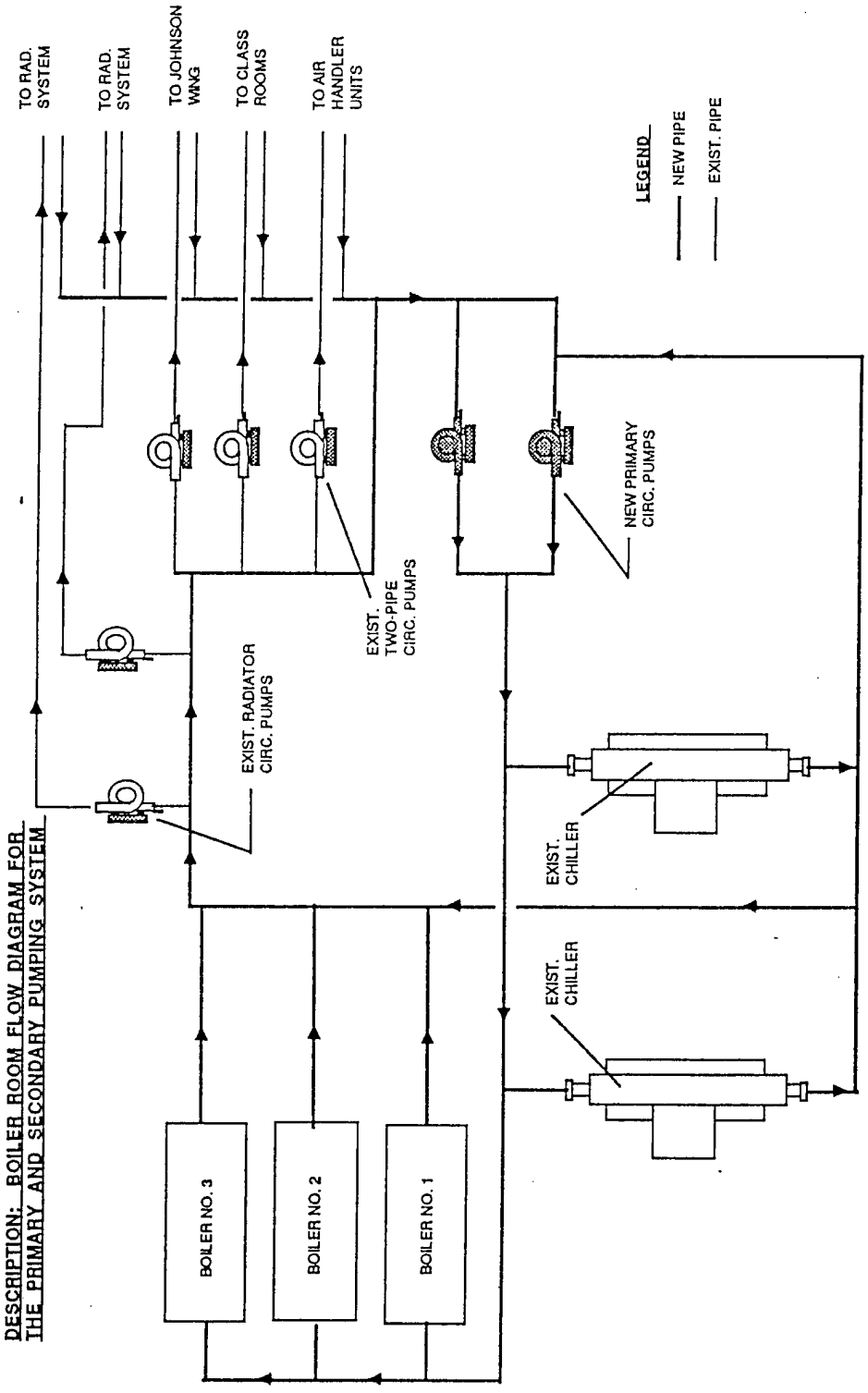
ECO-M1
FIGURE NO. 4



ECO-M9

FIGURE NO. 1

facilities requirements sketch, PDB- 1/2



ECO-M9
FIGURE NO. 2

facilities requirements sketch, PDB- 1/2

A. SPECIAL CONSIDERATIONS

	ITEM	Required or Not Required	To Be Determined *	Comment Attached	Document Attached
A-1	Cost estimates for each primary and supporting facility	R	D		√
A-2	Telecommunications system coordination with USACC & authorization for exemptions	NR			
A-3	Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permints, clearinghouse coordination, etc.)	NR			
A-4	Assignment of airspace	NR			
A-5	Economic analysis of alternatives	R			√
A-6	Approval for new starts	NR			
A-7	International balance of payments (IBOP) coordination with U.S. European command and NATO-overseas cost estimates and comparables (include rate of exchange used)	NR			
A-8	Impact on historic places-on site survey by authorized acheologist and coordination with state historic preservation officer and advisory council on historic preservation	NR			
A-9	Exceptions to established criteria	NR			
A-10	Coordination with various staff agencies (Provost Marshall-physical security, etc.)	NR			
A-11	Identification of related support projects (so projects can be coordinated)	R	B		
A-12	Required completion date	NR			
	Other Special Considerations (List and number items)				

REQUIRED OR NOT REQUIRED - Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED - Information needed by not currently available. Enter code for information souce.

COMMENT ATTACHED - Significant information summarized or explained and attached.

DOCUMENT ATTACHED - Significant information is in an existing document which is attached.

* BY WHOM (Check and insert appropriate letter)

A - DFAE
B - Using Service
C - Construction Service
D - Designer
E - Other (Check Comments Attached and explain)

documentation checklist

B. SITE DEVELOPMENT

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
B-1	Consultation with the District Office to determine and evaluate flood plain hazards	NR			
B-2	Preparation, submission, and/or approval of new				
(A)	General Site Plan	NR			
(B)	Annotated General Site Plan	NR			
(C)	Sketch Site Plan	NR			
(D)	Facilities Requirements Sketch	NR			
B-3	Preparation of				
(A)	Site Survey	NR			
(B)	Subsoil information	NR			
B-4	Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan				
	Other Site Development Considerations (List and number items)				

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documentation checklist

DA FORM 5023-B-R, Feb 82

C. ARCHITECTURAL & STRUCTURAL

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
C-1	Reconciliation with troop housing programs and requirements	NR			
C-2	Evaluation of existing facilities (including degree of utilization)	NR			
C-3	Approval for removal and relocation of existing useable facilities	NR			
C-4	Evaluation of off-post community facilities	NR			
C-5	Storage and maintenance facilities (including nuclear weapons)	NR			
C-6	Coordination hospitals, medical and dental facilities with Surgeon General	NR			
C-7	Coordination of aviation facilities with FAA	NR			
C-8	Coordination air traffic control and navigational aids with USACC	NR			
C-9	Tabulation of types and numbers of aircraft	NR			
C-10	Evaluation of laboratory, research and development, and technical maintenance facilities	NR			
C-11	Coordination chapels with Chief of Chaplains	NR			
C-12	Review food service facilities by USATSA	NR			
C-13	Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities	NR			
C-14	Coordination postal facilities with U.S. Postal Service Regional Director	NR			
C-15	Laundry and dry cleaning facilities coordination with ASD(I&L)	NR			
C-16	Tenant facilities coordination with installation where sited	R	A		
C-17	Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item B-4)	NR			
C-18	Analysis of deficiencies	R			✓
C-19	Consideration of alternatives	R			✓
C-20	Determination whether occupants will include physically handicapped or disabled persons	NR			
C-21	As-build drawings for alterations or additions	R	C		
C-22	Availability of Standard Design or site adaptable designs	NR			
	Other Architectural & Structural (List and number items)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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documentation checklist

DA FORM 5023-C-R, Feb 82

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
D-1	Fuel considerations and cost comparison analysis	NR			
D-2	Energy requirements appraisal (ERA)	NR			
D-3	Conformance with DOD Energy Reduction requirements	R	D		V
D-4	Evaluation of existing and/or proposed utility systems	NR			
	Other Mechanical and Utility Systems (List and number items)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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documentation checklist

DA FORM 5023-D-R, Feb 82

E. ENVIRONMENTAL CONSIDERATIONS

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
E-1	Environmental impact assessment	NR			
E-2	EIA conclusions require Environmental Impact Statement	NR			
E-3	Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency)	NR			
E-4	Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level	NR			
E-5	Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate.	NR			
	Other environmental considerations (list and number items)				

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E – Other (Check Comments Attached and explain)

documentation checklist

DA FORM 5023-E-R, Feb 82

A. SPECIAL CONSIDERATIONS

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
A-1	Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages	R	D		
A-2	Construction phasing requirements	R	D		
A-3	Functional support equipment (mechanical, electrical, structural, and security) to be built in	R	D		
A-4	Equipment in place and justification	NR			
A-5	Other equipment and furniture (O&MA, OPA) and costs	NR			
A-6	Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.)	NR			
A-7	Type of construction (permanent, temporary, semi-permanent)	R	D		
A-8	Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement.	NR			
	Other special considerations (list and number items)				

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C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-A-R, Feb 82

B. SITE DEVELOPMENT

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
B-1	Construction restrictions or guidelines pertaining to				
(A)	site access and preferred construction routes	NR			
(B)	Airfield clearance, explosive storage, working hours, safety, etc.	NR			
(C)	Facilities and/or functions or adjoining areas (structures, materials, impact)	NR			
B-2	Real estate actions (acquisition, disposal, lease, right-of-way)	NR			
B-3	Demolition/relocation required (data)				
(A)	Special considerations due to explosives/radioactivity/ chemical contamination/asbestos emissions/toxic gases	NR			
(B)	Restrictions on disposal of demolished/relocated material including hazardous waste	NR			
B-4	Pavement types and requirements (including traffic surveys and MTMC coordination)	NR			
B-5	Landscape considerations				
(A)	Protection of existing vegetation	NR			
(B)	Stockpile topsoil	NR			
	Other Site Development (List and number items)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-B-R, Feb 82

C. ARCHITECTURAL & STRUCTURAL

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
C-1	Vibration-producing equipment requiring isolation	R	D		
C-2	Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential)	R	D		
C-3	Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological)	NR			
C-4	Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing)	NR			
C-5	Designation and strength of units to be accommodated	NR			
C-6	Requirements and data for special design projects	NR			
C-7	Unusual floor and roof loads (safes, equipment)	NR			
C-8	Security features (arms rooms, vaults, interior secure areas)	NR			
	Other Architectural & Structural (List and number items)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-C-R, Feb 82

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
D-1	Special mechanical requirements or considerations (elevator, crane, hoist, etc.)	NR			
D-2	Special peak usage periods and peak leveling techniques	NR			
D-3	Maintenance considerations (accessibility of equipment, compatibility with existing equipment)	R	D		
D-4	Plumbing—availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas)	NR			
D-5	Heating—availability, general system type and characteristics (proposed and/or existing)	R	D		
D-6	Ventilating, air condition/refrigeration—availability, general system type and characteristics (proposed and/or existing)	R	D		
D-7	Electrical—availability, general system type and characteristics incl. airfield lighting, communication, etc. (proposed and/or existing)	R	D		
D-8	Water supply/waste treatment—availability, general system type and characteristics (proposed and/or existing)	NR			
D-9	Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.)	NR			
D-10	Solar energy evaluation				
	Other Mechanical & Utility Systems (List and number items)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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E – Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-D-R, Feb 82

E. ENVIRONMENTAL CONSIDERATIONS

ITEM		Required or Not Required	* To Be Determined	Comment Attached	Document Attached
E-1	Waste water treatment, air quality, and solid waste disposal criteria	NR			
	Other Environmental Considerations (List and number items)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-E-R, Feb 82

F. FIRE PROTECTION

ITEM		Required or Not Required	* To Be Determined	Comment Attached	Document Attached
F-1	Special fire protection systems or features (detection and suppression equipment, hazards, etc.)	NR			
	Other Fire Protection Considerations (List and number items)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-F-R, Feb 82

FORM 1391

1. COMPONENT	FY 1990 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		5-Jun-90

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
FORT LEAVENWORTH, KANSAS	HVAC Modifications (Bell Hall)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST
	80000		$700,000

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($OOO)
Steam and/or Chilled Water Distribution.				
Convert CHW system to Primary/Secondary Pumping	LS	1	$345,792	$346
Air Conditioning				
Convert Milti-Zone AHU to VAV	LS	1	$353,853	$354
Facility Subtotal			$699,645	$700

10. DESCRIPTION OF PROPOSED CONSTRUCTION

This project would convert 5 existing multi-zone air handling units to allow operation as variable air volume units and convert the existing constant volume chilled water pumping system to a variable flow primary/secondary pumping system.

The multi-zone units converted to VAV would serve the basement office area, library area, archive area, Eisenhower Auditorium area and the bookstore and barbershop area. The conversion would consist of a variable speed controller on the fan motors, control modifications, and installation of variable volume supply boxes in the individual areas.

The conversion of the constant volume pumping system would include, new primary circulation pumps, modifications to the chilled water and heating water piping loops, new variable speed controllers for the secondary circulation pumps and DDC control modifications.

The electrical savings is 8289 MBTU's per year and the the savings to investment ratio is 1.05.

1. COMPONENT **ARMY**	**FY 1990 MILITARY CONSTRUCTION PROJECT DATA**	2. DATE **Jun 5, 1990**
3. INSTALLATION AND LOCATION **FORT LEAVENWORTH, KANSAS**		
4. PROJECT TITLE **HVAC Modifications (Bell Hall)**		5. PROJECT NUMBER

11.J REMARKS:

This project will provide energy savings by increasing the efficiency of the Bell Hall HVAC systems.

11.K RELATED PROJECTS:

No other project are dependent upon this project.

11.L PROJECT:

Conversion of the existing multi-zone air handling units to allow operation as variable air volume units and conversion of the existing constant volume chilled water pumping system to a variable flow primary/secondary pumping system.

11.M REQUIREMENT

a. This project will aid in reducing the consumption of electricity to help meet national energy reduction goals which is the reason for the ESOS and ECIP programs.

b. All buildings will be in active use during the amortization period.

11.N CURRENT SITUATION:

Results from the field survey indicate that the existing systems are currently meeting the requirements cond of the facility. However, this project improves the efficiency of the HVAC systems by allowing them to modulate and follow the changes in the air conditioning loads. The current systems are constant volume and run at full air flow and water flow capacity all of the time, which uses more fan and pump horsepower than the variable flow systems.

11.O IMPACT IF NOT PROVIDED:

If this project is not approved, the electrical energy consumption will remain the same and will not contribute to the energy saving goals of the DOD.

1. COMPONENT **ARMY**	**FY 1990 MILITARY CONSTRUCTION PROJECT DATA**	2. DATE **5-Jun-90**
3. INSTALLATION AND LOCATION **FORT LEAVENWORTH, KANSAS**		
4. PROJECT TITLE **HVAC Modifications (Bell Hall)**		5. PROJECT NUMBER

D1. GENERAL:

This project is required as part of the DOD plan to reduce the energy consumption per gross square foot of building area . This project improves the efficiency of the air conditioning systems at Bell Hall, located at Fort Leavenworth. The primary mission of Ft. Leavenworth is the Military War College. This building is the primary center for this function. This project does not involve the arrival of a new weapons system.

D2. ACCOMMODATIONS NOW IN USE:

Building 111, Bell Hall.

D3. ANALYSIS OF DEFICIENCY:

Currently the existing multi-zone air handling units function as constant volume units that supply the same amount of air at varying temperatures. This requires the fans to operate at full capacity all of the time.The existing constant volume chilled water pumping system supplies the same amount of chilled water throughout the building, regardless of the cooling requirement. The temperatures are maintained by mixing return chilled water with the supply chilled water. This requires that the pumps operate at design capacity all of the time.

D4. CONSIDERATION OF ALTERNATIVES:

The alternatives to reduce fan and pump horsepower involve reducing air and water flows or modifying existing duct and piping supply & return systems to reduce pressure drops. Reducing the air and water flows was unacceptable because the system would not meet peak load requirements. Modifying the existing duct and piping alternatives were rejected because of high capitol costs and excessive downtime required for construction, and the minimal benefit.

D5. CRITERIA FOR PROPOSED CONSTRUCTION:

The proposed project will conform with all applicable Federal and US Army regulations.

D6. PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT:

Not applicable.

D7. DISPOSAL OF PRESENT ASSETS:

Not applicable.

D8. SURVIVAL MEASURES:

Not applicable.

D9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES:

This project has no environmental consequences , other than a reduction in energy use, which translates to a positive impact.

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D10. EVALUATION OF FLOOD HAZARDS:

Not applicable.

D11. ECONOMIC JUSTIFICATION:

See attached LCCID printouts.

D12. UTILITY AND COMMUNICATIONS SUPPORT:

No new utilities are required for support of this project.

D13.PROTECTION OF HISTORIC PLACES AND ARCHAEOLOGICAL SITES:

The proposed project will not alter building construction or appearance.

D14. PROJECT DEVELOPMENT BROCHURE:

A Project Development Brochure has been prepared.

D15. ENERGY REQUIREMENTS:

A summary of the results of the full energy study follows.:

Annu: 3840 MBTU's per year electricity
4450 MBTU's per year natural gas

Total : $690,140

Initial : $657,361

Savin : 1.05

D16. PROVISIONS FOR THE HANDICAPPED:

Not applicable.

D17. REAL PROPERTY MAINTENANCE ACTIVITY (RPMA):

The completion of this project will not have an impact on property maintenance.

D18. COMMERCIAL ACTIVITIES (CA) ANALYSIS:

Not applicable. This project does not constitute a new start or expansion.